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Original Contributions.

PATHOGENY OF OSTEOMALACIA OR SENILE ATROPHY.*

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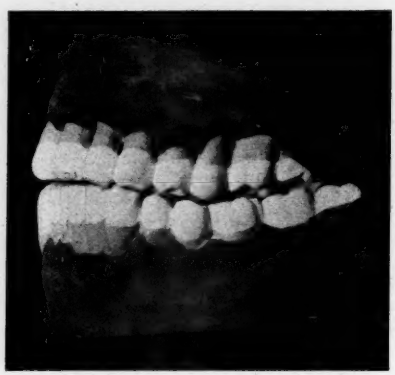
The fact that pathology at most implies a disturbance of balance which causes a conflict of physiologic processes is nowhere more evident than in osteomalacia. The current error which assumes that any process aiding disease must be innately nosologic interferes with diagnosis and treatment alike. The clinical and pathologic work done on osteomalacia has been much vitiated by the viewpoint just mentioned. Osteomalacia occurs from so many nosologic states as to indicate that it arises from a process physiologic in character, but perverted to nosologic ends by anything which disturbs the balance struggle for existence between the structures.

Bones do not grow in the ordinary sense, since the bone cells cannot multiply. Apparent growth of bone is caused by destruction of bone already formed and by production of new bone. The production of new bone is due, as Minot (Embryology) points out, first to degeneration of the ossifying cartilage. Cartilage begins to be differentiated earlier than any of the mesenchymal tissues except the blood vessels and perhaps the smooth muscle cells. Cartilage undergoes a degenerative change preparatory to ossifying. This is one of the many instances in the embryo where degeneration of a particular structure is necessary for advance of the body as a whole. There are,

*In "Interstitial Gingivitis or So-called Pyorrhea Alveolaris" I called attention to a form of bone absorption, osteomalacia or senile absorption. Very little was said at the time, for the reason that I wished to do more research work before bringing the subject before the profession. This paper was read before the Chicago Academy of Medicine, Dec. 12, 1899, and has never been published.

as Minot points out, two stages in the life history of cartilage. The first (in which the cells are large) is the earlier stage and represents the maximum of development, while the second (in which the cells are shrunken and fatty) represents a later stage with more or less degeneration. In what is called ossification of cartilage (an erroneous term) the cartilage undergoes complete degeneration and disappears. Bone is derived always by direct metamorphosis of embryonic connective tissue or of embryonic cartilage and of periosteum. Bony tissue, as already remarked, does not grow except by additions to its surface. To a certain extent it depends upon a balance between the metamorphosis of embryonic connective tissue, the formation of



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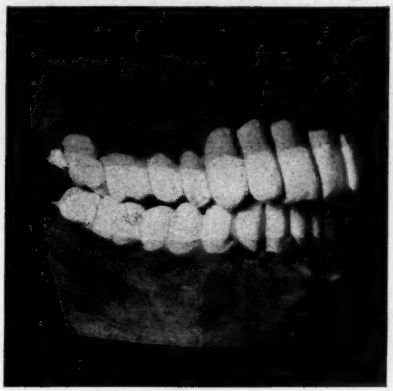
cartilage, and the function of the osteoblasts which build up and the osteoclasts which break down.

These four conditions occur in fracture. The tissue around and between the bone ends is provisional callus. The periosteum forms the external callus and the medullary tissue the internal callus. Ossification of internal callus is performed by the osteoblasts, which develop, and osteoid tissue that later by calcic deposits undergoes a change into true bone. This bone formation is often preceded by tissue of the embryonic connective type. The osteoclasts absorb bony substance in excess. Imperfect work by the osteoblast or excessive action of the osteoclast, with resultant undue embryonic tissue formation, would reproduce in a fracture the condition of tissue which occurs in osteomalacia. Osteomalacia hence depends

upon the removal of inhibitions on the physiologic balance between formative and destructive functions.

Inhibitions are exercised through the nervous system. It is not surprising, therefore, to find fully developed osteomalacia connected by many links with trophoneuroses in which similar local bone changes occur. Prominent among these are paretic dementia and locomotor ataxia. Various changes of the bones and joints, as J. G. Kiernan (*Journal of Nervous and Mental Diseases,* 1873, page 253) has pointed out, occur in paretic dementia either in the direction of osteomalacia, of premature and excessive ossification, or of hydro articuli (thickening of the articular extremities of the long bones).



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Similar conditions were found previously by Charcot, Ball and J. K. Mitchell in locomotor ataxia.

In other conditions where like though lesser disturbances of the physiologic balance of the struggle for assimilable nutriment occur, osteomalacia and its converse likewise develop. In pregnancy such conditions are present. So far as the woman is concerned, pregnancy, as Harriet Alexander (*Pediatrics,* January, 1901) has shown, is a pathologic balance hitherto existing in the organism. In consequence, nutrition and assimilation are increased while elimination is decreased. In pregnancy therefore occurs an autointoxication, which may express itself in major phenomena like eclampsia, or minor phenomena like the destruction of the teeth. From the influence of

this last type exercised on bone growth occur not only trophic disturbances, like osteomalacia, but also, as Rokitansky (*These de Paris*, No. 12, 1844) long ago demonstrated, osteophytes (of the cranial bones in particular). This condition, as Ducrest has shown, appears and disappears under pregnancy. While Hohl and Virchow have claimed that this condition bears merely a coincidental relation to pregnancy, corroboration of its frequency by French, German and Italian pathologists demolishes this criticism.

Osteomalacia (the halisteresis ossium of Kilian) consists anatomically of an osteitis and periosteitis in which the perfectly hard bones

are decalcified and are replaced at first by lamellar connective tissue; finally this passes centrally into the round granular medullary cell. The medullary spaces and Haversian canals increase in size, the bone corpuscles partly disappear, but in part become shorter and their processes smaller. The more complete the substitution of connective tissue the more flexible the bones become. In osteomalacia corea they are, as Winckel (Text-Book of Obstetrics (American Edition) page 472) remarks, almost as yielding as wax and not soft enough to be cut. In fully developed osteomalacia therefore the cartilage formation has been replaced by connective tissue.

Winckel has shown that the conditions under which puerperal osteomalacia develops are essentially those causing degeneration. By improvement of hygienic surroundings of Bavarian peasant women his father was able to lessen the amount of osteomalacia. It does not therefore form a single nosologic species. It is clearly connected with the trophic factors regulating bone growth, bone repair and bone existence. In its essence it is, like cancer, a reversion to embryonic conditions. While to some extent lower, the conditions found in osteomalacia are essentially those of the immature sea-squirt in its prevertebrate period. It is a general law of biology that structures in certain parts of an organism retain for the benefit of that organism lower characteristics. This being the case, there should be one structure in the body which would give a clue to the etiology and early pathology of osteomalacia. Such a structure is the alveolar process. This is situated upon the superior border of the inferior maxilla and upon the inferior border of the superior maxilla. While usually considered a part of the maxillary bones, the alveolar process should be considered separately. Its structure, embryology and functions differ completely from the structure and functions of the maxillary bone. The alveolar process is composed of soft, spongy bone of a relatively cancellous structure. As early as the eleventh week of intrauterine life calcification of the deciduous teeth commences, and by the twentieth week calcific material is quite abundantly deposited. The alveolar process, being soft and spongy, molds itself about the sacs containing the crowns of the teeth and along their roots after their eruption regardless of position in the jaw. While the alveolar process has grown rapidly it has developed up to this time just enough to cover and protect the follicles while calcification of the jaws proceeds. When the crowns have become calcified and the roots have begun to take in calcific material, absorption of the border of the process takes place in the order of eruption of the teeth. When the teeth have erupted the alveolar process develops downward and upward with the teeth until it attains the depth of the roots, which in most instances extend into the superior maxillary bones in the anterior part of the mouth, and the upper and lower teeth rest at a point in harmony with the rami. The depth to which they penetrate depends upon the length of the roots and the alveolar process, and this in turn depends upon the length of the rami. The incisive fossa, the cuspid eminence and fossa, give evidence of this

externally. The sockets are lined with extensions of the process, thus making its upper border irregular.

When the temporary teeth are shed the alveolar process is absorbed to make room for the eruption of the permanent set. The crowns of these, being larger than those of the temporary teeth, require more space and the process must enlarge to accommodate them. It then is rebuilt about the roots of the teeth on a much larger scale. When the temporary teeth are lost the alveolar process is resorbed. It is hence developed twice and absorbed thrice, provided the second set of teeth is lost. The process is a very thin unstable structure naturally well nourished with blood vessels. As the skull and brain are gaining in the struggle for existence between the face, jaws, skull and brain, the jaws with the alveolar process must decrease in size with advance. This fact and the changes just described render the process a doubly transitory structure. For this reason it is very susceptible to metabolic changes, to mineral and vegetable drugs and poisons, as well as to changes in temperature and climate. This is in part due to the readiness with which checked elimination elsewhere finds exit through the mouth and nose. The great supply of blood vessels in the alveolar process plays a part in determining elimination.

Should man live long enough, and should the physiologic process of involution set in, his second set of teeth would disappear as a consequence of osteomalacia of the senile atrophy type. The lower vertebrates are called polyphyodontia because there is a continuous succession of teeth, not a separation into two sets. In some mammals this condition persists. The pachyderms and rodents (who are connected embryologically) present phenomena analagous to that of the polyphyodontia. In the rodents, especially the nut-eating rodents, continuous growth occurs in the incisors as they are worn down. Should one of the incisors disappear the opposing one so grows as to interfere with the gnawing powers. Many a squirrel has thereby lost its life. In the elephant not more than three teeth are in use at a time. Those worn down are shed, while new teeth are added. (Tomes' Dental Anatomy, page 405.) Thus the whole number of teeth are not in place at one time. In other pachyderms, like the hyrax, similar conditions are found. Among edentates tooth conditions form a natural transition to the sauropsidae and icthyopsidae. A curious link also occurs in the monotremata, where the

duck-bill has deciduous teeth during youth which are afterwards absorbed to make way for horny plates. Judging from the conditions found in the toothed birds, the same result occurred at a phase in evolution of toothed birds from reptiles. In man, however, this degenerative process (involving absorption of the alveolar process and loss of the teeth) is continuously present in a latent way. The alveolar process is therefore more subject to change from altered metabolism due to trophic disorders of nutrition than other structures. Osteomalacia or senile absorption occurs with greater rapidity

and produces more decided change in the alveolar process than in other bones. Causes which would not affect bone structure elsewhere markedly derange it.

While osteomalacia may affect the alveolar process at any period of life after the eruption of the first set of teeth, it does not usually occur until the period between twenty-five and thirty-five. Before this the osseous system is in its constructive state and lime salts are being deposited rapidly. Later in life the constructive stage is complete and material sufficient only to repair waste is deposited. At the periods of stress metabolic changes are most active—during puberty and adolescence (fourteen to twenty-five), during the climacteric (forty to sixty), when uterine involution occurs in women and prostatic involution in men, and finally during senility (from

sixty upwards), when the disease is always present to a greater or lesser degree. While in allied conditions men are most influenced, in this disorder the sexes seem to be affected about equally. Here the influence of pregnancy comes into play. Pregnancy disturbs the physiologic balance hitherto existing, especially along the line of assimilation and elimination. The well known dental effects of pregnancy (whose underlying cause affects the alveolar process) are due to this factor. This is purely a constitutional affection.

Among the causes are nonelimination of toxic substances, whether due to autointoxication, to bacterial action, or to metallic and vege-

table drugs. Disorder or disease of any excretory organ (kidneys, bowels, skin or lungs) will produce the most marked effect, firstly upon the constitution of the blood, and secondly upon the alveolar process, with resultant osteomalacia.

The urine, as Bouchard has shown, contains each day in a normal individual sufficient toxins to cause death if not excreted. This condition is markedly increased after prolonged nervous explosions like those of epilepsy or hysteria. This was pointed out thirty years ago by Meynert, who demonstrated that the status epilepticus (condition of rapidly-recurring convulsions) was due to the accumula-

tions of a proteid body in the system. The status epilepticus is preceded by a decrease of toxins in the urine and succeeded by an increase. This is likewise true as to the influence of nonelimination by the other excretory organs (bowels, lungs and oral cavity), as well as to the non-exercise of its poison-destroying power by the liver. Nonelimination moreover interferes with ordinary digestive functions and hence increases its own extent. Another factor in autointoxication is production of toxic products in such quantity as to prevent destruction by organs like the liver and consequent elimination, since a product to be properly eliminated must be changed to a particular chemical type. Among the factors which affect both these elements of elimination is the power over growth and repair exercised by the nervous system. In part this influence is exerted through control of blood supply by the vasomotor nervous system, and in part by that direct control of the nervous system over tissue change which is known as its trophic function.

Both influences are affected by nerve strain. Sudden emotion may, as Bichat demonstrated decades ago, produce marked defects upon bile secretion and may occasion jaundice. Cases are far from infrequent in which emotions like jealousy produce a mimicry of gall-stone colic in neuropaths. Murchison, Christison and Thompson have traced attacks of biliary colic to jealousy. Other liver changes from sudden nervous disturbance, whether of mental type or not, are not rare. As mental impressions are communicated to the central nervous system purely through mechanical changes in the nerves, such influence must be purely material in operation. As the brain exercises a checking influence on the operations of the liver, these mental influences produce two effects. The mental shock increases the checking action of the central nervous system on the local ganglia of the liver, and destroys the checking action of the liver ganglia, and in consequence these go too fast, resulting in their exhaustion. Either of these conditions interferes with the poison-destroying action of the liver, and accumulation of waste products is the result.

What is true of the liver is true of the other organs. This is especially noticeable, as Tuke points out, in regard to the kidneys. The action of mental anxiety or suspense, in causing a copious discharge of pale fluid, is familiar enough to all, especially to the medical student about to present himself for examination, the amount being in a pretty direct ratio to his fear of being plucked. The fre-

quency of micturition may, however, arise from nervous irritability of the bladder without increase or even with diminished secretion. Still the action of the skin is usually checked, the extremities are cold, and the kidneys have to pump off the extra amount of fluid retained in the circulation. Elimination of the substance usually separated from the blood is diminished as compared with the aqueous character of the whole secretion. The odor may be affected by the emotions in man as in animals. Prout is of the opinion that mental anxiety will produce not only nonelimination but also change in the

chemical character, as indicated by odor and otherwise. Disturbances in the medulla produce, as Claude Bernard long ago showed, a markedly pale, excessive urine. These disturbances often arise from intellectual strain or emotional shock. The influence of emotional states on secreting processes, and thereby indirectly upon autointoxication states, is illustrated in the fact long ago pointed out by Tuke that pleasurable emotions increase the amount of gastric juices secreted, the opposite effect being produced by depressing passions. Beaumont found in a case of gastric fistula that anger or other severe emotions caused the gastric inner or mucous

coat to become morbidly red, dry and irritable, occasioning at the same time a temporary fit of indigestion.

The influence of fear and anxiety on the bowels is as well marked as that upon the bladder and kidneys. Apart from muscular action, defecation may become urgent or occur involuntarily from various causes. The increased secretion from the intestinal canal may occur from fear and in some cases from the altered character of the secretion itself. While in this respect the influence of fear may be incon-

venient in man, it naturally assists escape in some animals, as the skunk.

Emotions powerfully excite, modify or altogether suspend, as Tuke has shown, the organic functions. This influence is transmitted not only through the vasomotor nerves but through nerves in close relation to nutrition and secretion. When the excitement is of peripheral origin in sensory or afferent nerves, it excites their function by reflex action, so that as emotion arises it may excite the central nuclei of such afferent nerves, and this stimulus be reflected upon the efferent nerves, or it may act directly through the latter. Pleasurable emotions tend to excite the processes of nutrition, hence

the excitement of certain feelings may, if definitely directed, restore healthy action to an affected part. Violent emotions modify nutrition. Various forms of disease originating in perverted or defective nutrition may be caused primarily by emotional disturbance. Emotions, by causing a larger amount of blood to be transmitted to a gland, increase sensibility and warmth and stimulate its function or directly excite the process by their influence on nerves supplying the glands. Painful emotions may modify the quality (i. e. the relative proportion of the constituents) of the secretions.

Imperfect elimination of effete matter from the lungs is a fruitful source of autointoxication. The more marked forms are those of tuberculosis, in which there is great debility and in which there is greater waste than repair. Self-poisoning is continually going on and will continue until death. The chest capacity for the inhalation of pure air is almost nil, hence the blood is improperly oxygenated and soon ceases to convey nutriment to the tissues. Eighty per cent of criminals who die of tuberculosis in prisons have undeveloped chest walls. Degeneracy therefore cuts quite a figure in the role of autointoxication. Degenerates with contracted chest walls are, however, more frequently found. Many undeveloped individuals in every walk of life for this reason have tuberculosis. People with undeveloped chest walls and chest capacity may not have tuberculosis and yet may suffer from autointoxication. Those who have had pneumonia with adhesion, and who are thus unable to oxygenate the blood, are subject to this disease. Asthmatics and hay-fever patients suffer from autointoxication and alveolar absorption. When the skin is overstrained as to excretion through kidney and bowel overstrain, the lungs are forced to take on increased work with imperfect oxygenation as a result. This is noticed in the odor of the breath in Bright's disease and in the air-hunger of diabetes, etc. In nerve-strain states and in the condition described by Albu not only do excretory organs suffer but the secretions of those glands like salivary and buccal glands are so altered as to become irritants. These excretory conditions not only result upon autointoxication states but are modified by trophic nerve function alterations. By trophic changes are meant such tissue alterations as occur in morbid conditions from disordered function of the centers of nutrition. Peripheral as well as central may be involved. The well known law of Wallerian degeneration of nerve fibres is an illustration, the

posterior spinal ganglion acting as a trophic center for the fibres of the posterior root in the cord itself. Trophic action may therefore be peripheral, though in extensive changes as a rule central (cerebral or spinal) origin should be looked for.

The constitutional result of acute and chronic infection and contagions is apt to be an autointoxication plus the action of the germ toxin. All the exanthemata have at times been followed by wasting or necrosis of the alveolus. Here the condition is notably symmetric and accompanied by disorders of the osseous system elsewhere. The same is true of grip and tuberculosis. The well-marked disorder known as Riggs' disease has been charged by Peirce, Kirk, Rhein,

Robin and Magitot to the direct influence of an arthritic state (gouty and rheumatic) and regarded as a special type of arthritic manifestation. The alveolus is clearly vulnerable to the toxins of many infections. It is likewise quickly affected by some autotoxic influences from disordered metabolism. Its vital resistance to these agencies is less than that of other tissues. It is the earliest sacrifice when these or any toxins disturb the harmony of the organism.

A cause other than the actions of toxins exists for implication of these parts. Whenever tissue waste, whether local or general, exceeds repair there is trophic change. This latter depends directly upon disordered local or general nervous functions. Trophic altera-

tions from the first cause appear in growth disorders of the nails and loss of hair (alopecia) after fevers, the most familiarly obvious examples of this pathologic process. Of the other type are localized atrophies where the direct intervention of toxins can be excluded. The alveolus is liable to the first form of trophic deterioration. The influence of acute diseases upon the alveolus is probably thus exerted in many cases rather than by direct infection. Where no cause has been ascertained examination directed to this factor would probably reveal it. The general failure of the trophic centers after the prime of life (in senile states), which is attended with loss of teeth and wasting of the alveoli, is the most obvious instance of trophic failure affecting the part. Even simple anemia may thus give rise to alveolar wasting.

The more marked forms of constitutional disorders (typhoid fever, pneumonia, tuberculosis, syphilis, indigestion and pregnancy, etc.) produce intense results.

The second form of trophic failure in the alveolus is less prominent, since it generally coexists with overshadowing disturbance elsewhere which it creates to a certain extent. Cruveilier noticed its occurrence associated with simple paraplegia, regarding it as of nervous causation. In facial hemiatrophy local wasting of the alveolus has appeared before the disorder has involved the jaws generally. This is sometimes due to a local cause, but its occurrence and association with other neurotrophic symptoms are suggestive.

The causes which act locally to produce direct autointoxication are the toxic effects of mercury, lead, brass, uric and other acids, potassium iodid and allied agencies, acting in a similar manner to scurvy. While it is not the intention to discuss at length the toxic action of these substances, a case may be cited in illustration of their similarity of action and results upon the tissue. Garnier and Simon (*Arch. de Med. des Enfants,* July, 1901) have observed the case of a boy suffering from an obstinate enteritis. Milk was found to disagree, so a puree of vegetables and chopped meat was given. The boy improved for a while, but hematogenous jaundice occurred. On investigation the jaundice was found to be due to the action of lead upon the liver, the lead having been introduced into the food through a meat-chopper. In this case the usual symptoms of lead poisoning were absent, but through its action on the liver jaundice had ap-

peared. Scurvy produces the same train of symptoms as the metals, through its disturbance of metabolism.

The jaws of the hereditarily defective, whether defect be in the direction of advance or degeneracy, are fruitful soil for the development of osteomalacia. In the mouths of the congenital deaf, dumb, blind, feeble-minded and delinquent children osteomalacia attacks the alveolar process before the osseous system has reached its growth. Here, as a consequence of trophic change, metabolic action and premature senility, osteomalacia may occur in connection with the first set of teeth at two years or any period thereafter. This may be called juvenile osteomalacia. Regulating teeth and senile absorption are predisposing causes to osteomalacia.

Osteomalacia of the alveolar process is almost as common among domestic and wild animals in captivity as it is in man. Wild animals in zoologic gardens without proper exercise, in close confinement, with impure air, and fed upon too-easily digested food, naturally acquire autointoxication, resulting in osteomalacia. This is particularly noticeable in monkeys, whose changes of environment render them very susceptible to disease, especially tuberculosis. Trophic changes and impaired metabolism are thereby so impressed upon monkeys that not infrequently the first teeth become prematurely loose and drop out. The horse and cow are prone to this disease. Cattle return to the stable after a summer's sojourn in the field, and then, being fed upon a changed diet without the usual exercise of cutting grass with their teeth, undergo a reaction in their jaws and osteomalacia results. "Cribbing" of the horse is a marked illustration of the uneasy feeling resultant on this reaction. Cattle fed upon brewers' grain and slop suffer most. Dogs afford the best opportunity, however, for studying inflammation and osteomalacia among animals. Nearly every dog in the dog hospital suffers with this disease. Twenty-five per cent of roving dogs at four years of age have the disease. Eighty per cent of eight-year-old, at least ninety-five per cent of twelve-year-old, and all fourteen-year-old dogs have the disease. House dogs suffer to a marked extent with osteomalacia of the alveolar process, no doubt from being trained to house cleanliness, which interferes with natural excretion, causing autointoxication and odor.

The following models show the action of osteomalacia upon the jaws and teeth. Figure 1 is that of a physician thirty-six years of

age. Figure 2 is that of a physician thirty-eight years of age. Both of these gentlemen are apparently in the best of health. One has slight indigestion, which is the cause of absorption, the other took calomel for malaria fifteen years previous, this being a predisposing cause. In each case all the teeth are involved both inside and out. Some of the teeth are becoming loose. There is no pus in either case. The gums are apparently healthy.

In consulting the literature upon this subject I find that absorption of the alveolar process and recession of the gums has always been attributed to the severe use of the toothbrush. There are certain conditions in which the tooth-brush will assist absorption of the alveolar process. These are easily observed. I refer to the position of the cuspid teeth, where they stand prominently and are the most conspicuous part of the alveolar process. The bone over the roots is as thin as tissue paper, and the slightest friction causes a low form of inflammation, which in turn produces absorption of the bone, exposing the root. The brush never, however, produces senile atrophy in other parts of the mouth.

The absorption of the alveolar process in osteomalacia is not always uniform, as sometimes only one or two teeth are involved. Local conditions modify the extent of the disease. In most cases, however, there is a gradual absorption of bone about all the teeth.

The pathology of this disease about the teeth is not unlike that of osteomalacia of the pelvis, spine and other bones of the body, as demonstrated by Hektoen, halisteresis being the principal form of absorption. Perforating canal absorption, as described by Volkmann, is very common passing through fragments of bone. Lacunar absorption is also present and osteoclasts are frequently found. Howship's lacunae containing osteoclasts are found in the margin of irregular islands of bone. This form of absorption, while nearly always present, does not cut so much figure as halisteresis, it being much slower in its action. New osteoid tissue is rarely ever seen, since this absorption is a natural destruction of bone and is never reproduced.

Here, then, is the basic explanation of interstitial gingivitis or so-called pyorrhea alveolaris—osteomalacia or senile absorption is the underlying basis of this disease.

The preceding illustrations represent the alveolar process of a man forty-eight years of age, killed in an accident. The teeth and bone

decalcified in the usual way were prepared for the microscope. Figure 3 shows four areas of bone absorption called halisteresis (melting away of bone substance). The waste products become irritants in the blood stream and set up a low form of inflammation in the Haversian canals. The inflammation thus set up produces rapid absorption. Each of these local areas enlarges until they join. In this way large areas are produced. In the center of this illustration is seen an Haversian canal with active inflammation around it. The bone is absorbed. The inflammatory process is in the trabeculæ or fibrous part of the bone. Adjoining is a large area with bone absorption, but the fibrous part of bone remains unbroken. The inflammatory process is seen throughout. At the lower border of the picture are two large areas of bone absorption. The trabeculæ are seen, with round-celled infiltration, while the center is destroyed. At the right absorption and destruction of the trabeculæ are seen to the margin of the bone.

Figure 4 shows halisteresis at two Haversian canals. One area is much larger than the other. Both have met and the area of inflammation will be much enlarged. The trabeculæ are present and filled with round-celled infiltration.

Figure 5 illustrates a large area of absorption with destruction of the fibrous tissue to a larger extent. Around the border is seen a small amount of inflamed fibrous tissue. An artery, once an Haversian canal, is also seen. About the large area are also seen three Haversian canals with the inflammatory process just beginning.

Figure 6 shows four centers of absorption at Haversian canals. Through the picture may be seen dark lines running in all directions. These are vessels of Von Ebner, through which Volkmann's canal absorption takes place. A beautiful illustration of this is the canal running from one large area of absorption to the other.

Figure 7 shows the third form of bone absorption—lacunæ or osteoclast absorption. Here a large area of bone is destroyed by these large cells.

Figure 8 is a low power, showing the distribution of the alveolar process between the roots of two teeth. Very little of the bone remains. When the trabeculæ or fibrous tissue is destroyed in large areas, and especially in transitory structures, it is rarely restored.

Résumé.—1. Osteomalacia may and does exist for years in

pelvic and other bones before the symptoms can possibly be recognized by the physican or surgeon.

2. The object of this paper is to show that osteomalacia can be studied earliest in the alveolar process.

3. The alveolar process is the most transitory structure in the body. It develops twice and is absorbed thrice if the second set of teeth is shed. The evolution of the face, whereby the jaws are decreasing in size, with the many complications thereon resultant, render the jaws and alveolar process increasingly transitory.

4. In the evolution from the lowest vertebrates up there has been continuous succession of teeth (polyphyodont), as found in some selachians, a partial continuous succession as in some mammals, and a comparatively permanent set of teeth as in man. This shedding of teeth, due to a process called senile absorption, atavistic in type, takes place in everyone to a greater or less extent after forty-five years of age. Should man live in a comparatively healthy state long enough he would lose all teeth from this process.

5. Degenerate children, from precocity due to arrested development at the senile or simion period of intrauterine life, may show symptoms of this disease in connection with the first set of teeth at from six to ten years of age. A monkey which died of tuberculosis at one year had osteomalacia which exposed the roots of all the temporary teeth, while three had dropped out.

6. Constitutional causes like autointoxication and drug poisoning are the etiologic factors. Even the mildest types of autointoxication, due to indigestion, change in climate from hot to cold, and vice versa, with corresponding change in food, giving more work to some eliminating organs and less to others, as well as mild forms of drug poisoning, may be potent in this particular.

7. The effect of autointoxication and drug poisoning is first irritation through blood streams, often causing endarteritis obliterans. Since the arteries are terminal, irritation readily causes inflammation and halisteresis.

8. Osteomalacia is as common among wild animals in captivity as in domestic animals.

9. The influence of bacteria as a cause has not been demonstrated by Koch's law.

10. If due to autointoxication, the effete matter should be removed from the system.

11. Osteomalacia or senile atrophy is the basic explanation of interstitial gingivitis or so-called pyorrhea alveolaris.

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MENTAL TRAITS.

BY C. N. PEIRCE, D.D.S., PHILADELPHIA. READ BEFORE THE AMERICAN ACADEMY OF DENTAL SCIENCE, BOSTON, OCTOBER, 1902.

Some years since much of my time was spent in the microscopic examination of the aquatic invertebrata. It was not difficult to discern that as low in the scale of life as these organisms were they had apparent preferences, and whether estimated as conscious or unconscious, they did not hesitate to express their likes and dislikes by seeking the illuminated or darkened end of the stage or glass cell in which they were enclosed. The Hydra, for instance, seemed particularly averse to the brilliant rays of light, while the Ameba, simple in structure as it was, more indifferently, however, sought the light in preference to darkness. The inference to be drawn from the action of these primitive beings was that whatever course was pursued, it had to be assumed that it was consistent with the economy or well-being of the individual. That is, the light or the absence of light, whichever was selected, was that which was favorable to the growth and reproduction of the species.

Now, if these simple unorganized masses of sarcode or protoplasm display movements favorable to their health and reproduction, how much more decided would be the actions of more complex animals to promote the same object. If the foregoing is a correct statement, then in speaking or writing of any individual or group of

individuals it seems fair to assume that their conduct, be it the result of voluntary or involuntary actions, will be favorable to the promotion of life and its perpetuation. The question that meets us right here is, how far are these actions of which we have been speaking the subject or result of environment? This is a factor that must certainly always be considered, for it matters not what the action, environment plays its part.

I have placed as a title to this paper, Mental Traits. The question confronting us is, how are the mental traits to be defined, or what do we understand by the term mind—impressions, ideas, thought, what else can we add to these so that this term may represent the sum of them? Is there any more comprehensive answer of those activities which distinguish living from dead matter, the organized from the inorganic? From this the Flora must necessarily be eliminated, for modern studies have not yet added that mental function to the vegetable kingdom.

In speaking of mind it must not be forgotten that two things are inferred, something which knows and something to be known; knowledge or intelligence then is the evidence of mind. Evolutionary or transformative processes must not overlook the fact that the mind of the more complex or higher mammalia is but a modification of those lower in the scale of life, differing from them in degree rather than in kind. And to these then we are under obligations greater or more important than recognized, for have they not attributes or emotions, which in man represent love and hate, fear and affection, sorrow and joy? Or is evidence wanting that mental progress is found in the brute? The query meeting us here is, what is man's proud prerogative? In what is the distinction between man and brute? It was said nearly two centuries ago by Locke, that the having of general ideas, ideation, may we call it, was the border line. Idea is the image or representation of anything in the mind, such as sensation, perception, conception, thought, in short, of whatever we are at different times mentally conscious. It is thought and its expression then which make man. Outside of this all that man has of soul or mind he has in common with the brute. He need not be ashamed of it, nor need he try to divorce himself from this distant relative to whom Nature has bound him so closely.

In the study of mental traits we have to recognize that there are peculiarities of peoples, tribes, groups and nations dividing each

from the other to such an extent that it has been claimed mankind can be classified by the relative development of their mental powers. These mental traits, characteristics, differences between human groups, are just the material which Ethnic Psychology takes as a legitimate subject for investigation. It claims that the separation of mankind into groups by psychical differences is a very necessary condition of human progress everywhere and at all times, therefore the study of causes of these differences and the influence they exert in the direction of evolution or regression is most essential to the present and future welfare of humanity.

We have just spoken of peoples, tribes, groups and nations—do we realize that progress or evolution of the isolated individual is not possible? To advance, improve, progress, there must be association with others. It is only by giving and receiving, borrowing and lending, that life has been improved. Culture, civilization, has been the result of contest, rivalry, competition. Little does one appreciate what ambition and strife have done for civilization, and how much the grouping of individuals has favored this desirable condition. It has been the warlike and destructive spirit of the uncultured that has been transformed and utilized for the advantage of the cultured. In like manner it is not difficult to anticipate how by the evolution or growth of mind, and by the accumulated and inherited effects of experience, we may have the moral sentiments developed. Having these, there would naturally arise altruistic actions, which would adjust themselves to conduct that would become permanently beneficial by conforming to the welfare of individuals in the associated state. Following these advantages we would have by evolutionary processes the sacredness of life, liberty and property. Instinct, habit, repetition, seem to be attributes of the uncultured, while intelligence, change, improvement, belong to the cultured; one the result of education and knowledge, while superstition and emotional attacks in the unconscious and ignorant demand faith in the unseen and an effort to enforce obedience without investigation.

In associating the individual with the group the less are his peculiarities made prominent, or the more closely does he become associated with the mass and the more do his thoughts and traits turn out to be those of others, or, to put it tersely, the less baggage does he have which is really his own. Morally and mentally he be-

comes as much a part of society as he is physically a part of the world's fauna. The group possesses another advantage over the individual. It may, it probably will, live, the individual will certainly die. Again, in the group personal ambition and petty jealousies soon sink into oblivion, the social order of which they were a part survives and younger generations are thereby benefited. The group as a physical unit is not creative but receptive and executive; for its inspiration it relies upon the individual. Our Bosses in politics illustrate the power of the individual, but without the aid of the group what could they accomplish? This political group is made up of individuals who have varying or divergent mental traits, and it is the diversity of talent that is most valuable in keeping it from degeneration or decay. The vital energy that is essential in the protection of society from retrogression, and that confers upon it the blessings of eternal youth, is that each individual shall enjoy the unrestricted opportunity for the full development of his or her faculties.

Many examples might be given of the influence of restriction but one will suffice. The condition of Spain compared with other civilized countries is conspicuous. One has but to visit Gibraltar and see her people side by side with the English to note the contrast either as soldiers or civilians. Hemmed in by castes, classes, or religious institutions, every inspiration stifled, how else could their souls be but atrophied, degenerated, incapable of performing satisfactorily the normal functions of life?

We have already said the group does not originate but is receptive; in the individual changes have their origin by transmission or inheritance, and if beneficial they work profit until their utility ceases, then the energy that has been expended on them is devoted to other structures or faculties. In the individual there is a remarkable fact connected with functionless structure—they may have become atrophied or degenerated but they seldom wholly disappear. It is in consequence of this persistence in traits and structures that our ancestors hold so unyielding a hand upon our life and development. The presence of many of these structures gives us little satisfaction beyond indicating the road we have traveled.

Adaptation to environment taxes plant and animal life alike. Adaptability favors the strong, the weak and unyielding succumb. Man tries hard to mold his new and untried conditions to his will, he

desires to be master not slave. In cold climates he builds a hut and utilizes Nature's gifts in place of heat; in diet he adapts his jaw movement to flesh or rice; in dealing with rain or hot sun he spreads an umbrella or an awning and thus protects himself from heat and wet; his ingenuity and willingness to work make him master of his purpose. Voluntary and involuntary activities mark the difference between the instinctive and reflective, between bondage and freedom, between the cultured and uncultured of humanity.

Man to-day is a tool-using animal, and those with the most efficient instruments will dictate terms to the less favored. When the Neolithic man replaced his arrow head with a bronze sword he carried his tribe a long distance on the road to civilization. This was well illustrated in the late contest between the United States and Spain, victory being with those who handled the superior weapons. Through the same influence the sickle has given way to the scythe, the scythe to the mowing machine, horse power surrenders to steam, and steam to-day is yielding to electricity. In this the dream of life becomes the revelation of to-day, and invention sweeps habit from the field. True, adaptability in man is purposed conscious action. One who is willing to sacrifice the present for the future must possess intelligence and self-control, with impulse or passion curbed into obedience.

In appreciating the great advantage man has gained over the lower mammals it must not be forgotten that he has paid very dearly for his superiority, for while he has grown in brain capacity and education he has suffered in many things which would have served him well could he have retained them. Instinct, which was the guide of early ancestors, has not been transmitted, nor has the acuteness of the senses, sight and hearing, been retained by man as enjoyed by other animals. The concentration of energies in any one field must necessarily limit capacity for different lines of thought and work. For instance, if war were the only honorable vocation, then capacity for peaceful life would be much curtailed. The same may be said of theology when it occupies the mind to the exclusion of other interests. Again, the Society of Friends (Quakers) who for two hundred and fifty years discouraged music and the arts have lost to a marked extent the esthetic faculties, but they are not without great gain in other directions; the measure of their compensation tells in their thrift and wealth. The disuse of any talent is an important factor in modifying character.

PULP HYPERTROPHY OF THE TEETH.

BY DR. VON RÖMER, STRASSBURG, GERMANY. READ BEFORE THE SECTION ON STOMATOLOGY, AMERICAN MEDICAL ASSOCIATION, MAY, 1903.

I was first led to the histologic examination of pulp hypertrophy by the desire to find the conditions of the nerve-supply in this so highly altered pathologic tissue. In the study of the nerves I found not only what I expected, partly complete absence of nerves and partly marked decrease of nerve-fibers, thus explaining the great difference of sensitiveness, but also some other interesting discoveries which I believe are new.

Pulp hypertrophy is to be considered as a new tissue formation due to chronic pulpitis from exposure through more or less complete destruction of the overlying protective tissues. This new growth consists of a comparatively coarse granulation tissue in which three layers can be distinguished. The outer layer consists of a thick stratum of white blood- or pus-corpuscles beginning to break down, then follows a somewhat wider zone consisting of a proliferation of endothelial cells and capillary vessels, which, seen with a less magnifying power, has almost the appearance of granular layer, similar to that before described in the so-called endothelial granuloma of the dental root. The third layer, which forms the chief mass of the tumor, consists of a coarse connective tissue with dilated blood-vessels interspersed with crowded round cells.

Up to the present I have studied about thirty different specimens, mostly obtained in clinics, and have prepared them in the following manner: First, the whole tooth with the pulp *in situ* in a ten per cent formalin solution, then decalcified it in a thirty-three and one-third per cent formic acid solution (which is, as a rule, accomplished in two or three weeks), then divided the tooth, together with the hypertrophied pulp, into two nearly equal halves. Such of the halves as seemed most suited for further treatment for microscopic examination were taken. These were embedded in celloidin and cut with the microtome into the thinnest possible layers and then stained with alum, hematoxylin, and picrofuchsin (Van Gieson), and part with Weigert's medullary staining process, in which the nerves and their medullary layers appear as dark, blue-colored fibers on a yellowish background. This shows that in so-called pulp hypertrophy (which

arises like a fungus from the pulp-chamber and generally fills the carious part crown of the tooth) nerve-fibers are absent. In the pulp-cavity itself and in the root-canals, on the other hand, numerous nerve-bundles are found according to the degree of degeneration of the pulp-tissue. This degeneration consists in a transformation into granulation tissue, particularly where infiltration with round cells changes into granulation. The nerve-fibers are already broken down or beginning to be degenerated, as shown by distortions, interruptions, and knot-formed swellings of the nerve-fibers. Such degenerative processes of the nerves can best be seen in pulps which have been laid bare by fracture in attempts at extraction, and in which the superficies of the exposed pulp is changed into granulation tissue and pulp hypertrophy.

The study of preparations stained by the Van Gieson method has convinced me that the difference claimed by Rothmund and Arkövy between pulp hypertrophy and pulpitis chronica hypertrophica granulomatosa does not exist. By the pulpitis chronica hypertrophica granulomatosa is understood (according to Rothmund and Arkövy; compare Scheff's Handbuch, Band ii. Seite 297) a granulating mass of the pulp from the size of a millet-seed to a pea, soft, with little consistency, and extending over one or two pulp-points. The hypertrophy, on the other hand, which Arkövy calls pulpitis chronica sarcomatosa is a compact, dense neoplasm caused by proliferation of the pulp-tissue, distinctly limited, generally smooth, and only here and there slightly lobular, less vascular, extending over the whole pulp-cavity, except perhaps some very slight portion including the whole crown cavity of the tooth.

I find neither clinically nor histologically any noticeable difference in the two forms. Both forms of hypertrophic pulpitis differ only in their size, and agree perfectly in their histologic structure. The fleshy, round bean or hazel-nut pulp hypertrophy develops simply through its natural growth from the minute millet-seed or pea-sized neoplasm. In both cases there is a degeneration of pulp-tissue and transformation into a more or less coarse granulation tissue, which consists of connective-tissue fibers with numerous blood-vessels, round cells, and proliferated endothelium and connective-tissue cells.

The striking point in all the specimens is the richness of blood-supply. The vessels are not only numerous but also dilated, almost

like a hemangeioma, so that after extraction of the tooth the hypertrophy loses half its volume.

In almost all cases of pulp hypertrophy there is found to some extent the formation of partly attached, partly free pulp-stones and calcareous deposits. This is in itself not astonishing, since in nearly all teeth which suffer from any kind of pulpitis, calcic formations are present to the discomfiture of the investigator, and even in well-decalcified preparations they often cause inconvenient nicking of the microtome knife. But what is here remarkable is the fact that in many hypertrophied pulps such calcareous formations occur well above the pulp-chamber and the hypertrophy itself. These calcareous masses or pulp-stones are in part round or oval, with distinct stratifications and partly irregularly dentate, and show cell inclusions similar to those which are found in the formation of secondary dentin inside the pulp-chamber.

How can these things be explained? I believe the pulp hypertrophy occurs only in teeth the pulp elements of which possess great vital energy and capacity for regeneration and in which they can oppose special resistance against incoming bacteria and other morbid influences.

The formation of secondary dentin partly attached to the walls and partly free is to be considered an attempt at defense from external injury. The quicker the pulp is compelled to form secondary dentin the more irregular will be its formation, so the calcification does not follow regular rules and the dentin is not laid down in regular layers, but the pulp-cells are included in rapidly-formed irregular dentin structure. Such pulp-cells, so over-energetic in dentin formation, may here and there extend with the granulation tissue beyond the pulp-chamber itself, and thus, far away from their original site, form on the crown of the hypertrophy such pulp-stones as are shown in some of my specimens.

Some things shown appear at first rather difficult to explain. Thus in one case the surface is covered with regular stratified epithelium instead of the usual round cells and pus-corpuscles, also with the high papillæ which are typical of the gum tissue. How does this epithelium develop on the pulp? Usually the excised fragment of a pulp hypertrophy is readily distinguished from a corresponding fragment of an alveolar growth by the absence of epithelium. I explain the process as follows: Hypertrophied pulps

are frequently ingrafted with alveolar growths; that is, when a pulp hypertrophy extends outside a pulp-chamber over the corroded wall of the crown in contact with the gum tissue. Both are easily injured in chewing, so that spontaneous autotransplantation from the gum tissue to the pulp hypertrophy occurs. Six months after preparing the one specimen I found another which demonstrated conclusively the truth of this conjecture. I have seen gum tissue grown over the completely destroyed crown of the tooth of which one was united with the broad surface of the pulp hypertrophy in the pulp-chamber. The whole surface of this hypertrophy was already covered with epithelium of the same composition and height of papillæ as that possessed by the alveolar tissue. Later I had an opportunity to separate the gum overgrowth from the pulp and there remained then only the pulp hypertrophy covered with epithelium.

In conclusion, a few words on the therapy of pulp hypertrophies. In cases where the pulp has one of these growths (they are vascular and at the same time poorly innervated), they may be either simply amputated with a pair of fine scissors or pointed knife in the depth of the pulp-chamber, and then arsenic paste be applied to cause necrosis of the root-pulp, or the paste can be applied direct to the crown of the hypertrophy in order to destroy by necrosis the entire tissue. But there is no serious error, in my opinion, in avoiding the use of arsenic altogether, but simply cut off the top of the hypertrophy and cap the stump.

NOTES ON PULP TECHNIQUE.

BY MARTHA ANDERSON, M.D. READ BEFORE THE SECTION ON STOMATOLOGY, AMERICAN MEDICAL ASSOCIATION, MAY, 1903.

The comparative value of methods and stains used for nerve-tissue in other parts of the body has never (to my knowledge) been demonstrated on the pulps of the teeth. My studies for the past four years have been along this line, and while the work has not been complete I am able to show some results. I herewith submit the results of my investigations of the past year.

In the work of preparing pulps for the demonstration of nerve-tissue the following methods of procedure have been carried out. Fresh pulps have been hardened in a weak solution of formalin, in

Müller's fluid, Erliki's fluid, and in Weigert's chrome alum solution, which formula is as follows:

Chrome alum, two and one-half per cent.
Copper acetate (neutral), five per cent.
Acetic acid, five per cent.
Formalin, two to four per cent.

Dissolve the alum in the necessary water, add acetic acid, then copper acetate. Filter, and when cold add formalin.

Sections were cut by the freezing method, then stained by one of the following methods:

(*a*) Weigert's method for medullated nerves:.

Copper acetate neutral sat. aq. sol. + aq. dest., āā (warm) 24 hours.

Wash.
Weigert's hematoxylin, 24 to 48 hours.
Weigert's differentiating sol., few minutes.
Wash.
Dehydrate clear and mount in balsam.

(*b*) Osmic acid and hematoxylin:

OsO_4, one per cent, ½ to 1 hour (dark).
Wash.
Pyrogallic acid, five per cent, 3 to 4 minutes.
Wash.
K. permanganate, one-fourth per cent, 3 to 4 minutes.
Wash.
Oxalic acid, one per cent, ½ minute.
Wash.
Counterstain in hematoxylin.
Wash, dehydrate, clear, and mount.

(*c*) Mummery's iron and tannin:

Wash sections in distilled water.
Liquor ferri perchlor. B. P., 24 hours.
Wash quickly in distilled water.
Tannic acid, gr. ii to ℥iss, 5 to 10 minutes.
Wash, dehydrate, clear, and mount.

(*d*) Iron and hematoxylin:

Zenker's fluid.
Wash.
Mordant, liquor ferri chlor., 24 hours.

Wash thoroughly.
Hematoxylin, one-half to one per cent aq.
Wash well.
Decolorize weak mordant till pale straw.
Wash thoroughly (or will fade).
Dehydrate, clear, and mount.
(*e*) Freud's gold:
Wash water.
$AuCl_3$, one per cent, 3 to 5 hours (dark).
Wash.
Caustic soda, 1 to 5 or 6 water, 3 minutes dark.
Drain.
K. I., ten to twelve per cent, 5 to 15 minutes.
Wash, dehydrate, clear, and mount.
(*f*) Underwood's gold:
Wash in Na. bicarb. sol., gr. v to ℥i.
$SuCl_3$ neutralized by Na. bicarb. sol. gtt. by gtt., ½ to 1 hour dark.
Wash dist. water.
Formic acid, one per cent, warm and keep rather hot till crimson, ½ to 1 hour dark.
Dist. water, cold, ½ hour.
Dry.
Mount in glycerin jelly.
Avoid Canada balsam.
(*g*) Lemon-juice and gold:
Lemon-juice strained several times through flannel 10 to 15 min.
$AuCl_3$, one per cent (dark), 1 hour.
Wash rapidly.
Formic acid, twenty-five per cent (dark), 24 hours.
Transfer to glycerin and mount in glycerin.

Weigert's stain for medullated nerves was used on tissues hardened in Müller's fluid, formalin, and Weigert's chrome alum, and good results were obtained with both Müller's and formalin-hardened tissues, the medullated sheaths of the nerves taking the stain.

The osmic acid method was used similarly to the above, and gave good results following Weigert's chrome alum solution.

Mummery's iron and tannin used after Müller's fluid stained the nerve-fibers, but the results were not so good as with the two

previous stains. Mr. Howard Mummery, however, has been able by this stain to trace fine nerve-fibers from the nerve-bundles.

Iron and hematoxylin gave good results, the fibers in some places being traced to the apex of the pulp.

Of the different gold methods Freud's has given me the best results, although some of the results of staining tissues hardened by all the methods have been good. Gold staining on the whole has been unsatisfactory. The staining has been unreliable. In carrying a number of sections through together by the same process some will be acted upon by the stain, showing a good result; others will be unaffected.

With certain of the nerve-stains the pulp-stones have taken the same stain as the nerve-tissues. The osmic acid method is an exception, the stain reacting differently upon the stones.

RELATION OF THE GENERAL PRACTITIONER TO ORTHODONTIA.

BY T. H. BARRETT, D.D.S., OTTAWA, ILL. READ BEFORE THE ILLINOIS STATE DENTAL SOCIETY, AT BLOOMINGTON, MAY 12-14, 1903.

In announcing the subject of this paper I might well add "by a general practitioner," for it is from that standpoint that I shall speak, and what I shall say will be based upon the observations and experiences I have gained from that line of work in a general practice.

In the past far too little attention was paid to this particular branch of dentistry, but at present it is beginning to assume its rightful place, as is evidenced by the society discussions, the articles in the journals, the attention it is receiving in some of the leading colleges, and last but not least, the invitation kindly extended to me to read at this meeting this paper prepared originally for a local society.

To prove that the dental graduate of the past was not so thoroughly instructed as he might have been, I need only relate the history of my first case. It will be brief, as you will see later. A boy of twelve called with an inlocked central. I ligated a short alignment wire to the bicuspids, and carried rubber bands from those points by simply looping them over the projecting ends of the wire outside of the other teeth, and passed them back of the malposed

central. I knew that to extract a tooth took a good deal of force, and those rubber bands seemed very weak, so I put on six or seven of them and told the boy to come back in the morning, and if that was not enough I would put more on. He came in promptly on time when—lo and behold—the case was finished! If that wire had not been in front of the tooth I should have discovered a new method of extraction, but fortunately it saved me and the tooth. I supported the tooth a few days with ligatures until the soreness had passed out enough for it to be released, when it was prevented from returning by the lower incisors. Happily no ill effect came of it. The patient is now a grown man and the tooth is perfectly in line, but I do not recommend or practice the "over night" method.

I believe as a rule orthodontia is not yet properly taught in the colleges, and too much time is consumed in the making of appliances, when one can buy better ones from the supply houses or have them made by a jeweler. I do not mean that one should buy a stereotyped form of appliance, but rather that he should purchase the various parts and then assemble them to meet the requirements of the case in hand. In short, it is better to know what can be done with a jack-screw, than to be able to make that jack-screw. It is desirable to have a working knowledge rather than a constructive one.

The graduate, who is to become the general practitioner, should be well grounded in all the underlying principles of orthodontia, including occlusion, contours, physiological changes, the influences of the tongue, lips and cheeks, and of pathological conditions of the mouth, nose and throat, as well as be familiar with all the various systems.

The colleges usually give a "one-man" system, for their professors are specialists, and specialists in this line are enthusiasts for their own individual methods. As teachers they should keep in mind that they are instructing those who are to be general practitioners, and as such will have to deal with cases where for many reasons one system, though it might accomplish the desired result, would not be nearly so practical as some other. We are called on sometimes to do such work for persons living so far away that frequent visits are impossible, and we must therefore contrive an appliance that is almost self-acting, or that can be operated by the patient or some member of his family.

So I say that while the graduate cannot be expected to be thoroughly familiar with all the methods of the various operators in their minutest details, he should have such a general knowledge that he may adapt the simplest and most practical appliance to any case presented, for in practice he will be called on more and more to do this class of work, since we cannot have specialists in any but the largest cities.

Now to bring the matter back strictly to our topic, let us suppose that a case presents to me and let us discuss the various points to be considered and decided from that time until the case is finished. After a careful examination of the mouth, taking age and health as well as other matters into account, say I decide to regulate. I would then take careful impressions of both upper and lower dentures and gums, and make an appointment for a few days later, when the patient should come and bring with him both parents if possible for further discussion and mutual information. Before that time I would secure good models and thoroughly study them to satisfy myself of the exact conditions of occlusion and malocclusion, the spaces that exist or must be created, the movements that must be produced, and the opportunities for sufficient anchorage. Then I would plan my appliance, making it as simple and inconspicuous as possible, and interfering with speech and mastication no more than is absolutely necessary. I would also decide as well as I could as to the probable etiology of the case. Here is a long list of causes to be gone through, but I will touch on each of them only briefly. First I would consider the simpler causes or those that might be apparent from the study of models, as the long retention of deciduous teeth, which might be shown by some of the succeeding teeth not being as properly erupted as they should be at that age and as compared with other teeth in like location; then the premature extraction of deciduous teeth, shown by the absorption of the process and the crowding of adjacent teeth upon the space the temporary teeth should have held; next injudicious or unfortunate extraction of permanent teeth; supernumerary teeth and delayed eruption, for all of which there would appear prima facie evidence. Accidents or habits (thumb, lip or tongue-sucking) might be the cause and could be determined only by questioning the parents.

Prognathism is a cause, as shown by the tendency of the mandible to move forward in edentulous old persons, and is produced by in-

sufficient development of the upper maxilla and by the lack of mechanical retaining force as exerted by the proper articulation of posterior teeth. I have models with me which will show this nicely, and which will demonstrate the wisdom of early interference in some cases—in fact, they are a whole sermon in many ways. This condition, however, and superior protrusion, "saddle-arch" and "V-arch," so-called, I think should not be classed as specific causes, as they are by some authors, for they are so intimately associated with some of those already given, and with adenoid vegetations, polypi and enlarged tonsils, that they will have been brought out in the study of these. I wish to lay particular stress on the importance of the effects of the naso-pharyngeal conditions and urge you to a close study of the subject. Dr. Kohler, the well-known rhinologist of Minneapolis, recently gave a most excellent paper referring to this. (DIGEST for May, 1903, page 611.) Personally I should not think of undertaking a case of regulating where there was evidence of such a condition until a specialist in that line had been consulted and the trouble corrected.

My paper would be far too long if I dwelt on this subject, so I will simply say that the ill effects of these conditions come directly from the lack of development of the osseous tissues contiguous to the oral cavity, thus producing a high and narrow vault with insufficient room for the teeth, and indirectly from the necessity of mouth-breathing, with the action of the various muscles and the holding-off of the occlusion of the posterior teeth.

There is now left for consideration only heredity. The evidence of inheritance is perhaps nowhere more clearly shown than in the teeth, be they normal or otherwise, for have you not frequently been able to say, "Are you not the son or daughter, brother or sister of so-and-so? I know it by your teeth." Where we have the intermarriage of people whose characteristics in regard to their teeth and jaws vary widely we are apt to have irregularity of the teeth as a result, or where either parent has a marked malarrangement that condition is likely to develop in the offspring. The given peculiarity may even be derived from a more remote ancestor, so this matter must be gone into thoroughly if no other probable cause should appear.

It is for the purpose of obtaining such information as the models do not show that I like to have both parents present at the second appointment, not only for what they may be able to tell but for the

opportunity of examining their teeth and jaws. After explaining fully to them what I can do, what appliances and work will be necessary, and what benefits will come, I believe that the matter of cost should be touched upon, at least in a general way. Remember, I am speaking now of general practice, and the fees for this work should be more than patients are in the habit of paying for most other operations or may be willing to pay for something they know so little about.

Let us now suppose all points are settled satisfactorily. The sitting should then be terminated, after we have drawn waxed linen strips about one-eighth of an inch wide into all the spaces where the bands of the already-planned appliance are to pass, and have made an appointment for the patient to come next day.

I have already stated the requirements an appliance should possess, but wish to say here, however, that I prefer and use if possible the positive system, screws and nuts, for one can tell exactly what he is doing and the teeth need not be made the least bit sore if they are properly manipulated. I repeat, you need not have pain and soreness if you use a fixed, positive, and well-constructed appliance. This has been my experience, and a study of the physiological changes due to tooth movement will bear out such a conclusion. I admit that I sometimes use wire and silk ligatures and rubber bands, for there are cases for which I cannot plan a simple, rapid-moving appliance without them, but where I do use them it is in such a way that by placing on the teeth bands carrying suitable attachments, and by having the alignment wires firmly supported, there is no slipping and sliding and they become actually positive in their operation, except that they are constant in their application of force instead of intermittent, as is the case with screws and nuts. Whatever system is used you must be absolutely sure that the anchorage is sufficient, for it is known that a "force that may be applied directly upon the object to be moved (without the intervention of a lever system) produces a stress equal to the force."

It is next day now and here is my patient, so I must fit the bands. This I do by taking out the tapes and looping Angle's band material around each tooth, drawing it tight and pinching up with flat-nosed pliers. (You see I do not approve of clamp bands.) I then take them all to the laboratory, cut the excess ends off about one-eighth of an inch from the bands, and bind these ends together with small

wire, after which I flux and solder with 20 k. I use wire for holding the ends together because by any other method so much heat is necessary that the band is frequently burned or injured and allowed to spring open. With this method I have no such trouble. Next I properly trim the bands and adjust them on the teeth, then take an accurate impression, remove, replace bands in impression, and pour in plaster and sand. Then tell the patient to come after such time as is needed to complete appliance, calling the day previous to such appointment to again have the tapes put in.

I then take this model and construct every part of the appliance on it, using either of the models previously procured if it is necessary to note the articulation. Getting each piece properly fitted and lined up, I wax it to place, putting in every screw and alignment wire just as they are to go in the mouth, taking particular pains that when they come to be operated they shall not elongate or shorten, unless desired, nor rotate or fail to rotate the teeth they are to move or that afford them support. I then take off all removable pieces and invest all the others I expect to solder by soaking the model in water and adding to it plaster and sand to cover all but the wax. After allowing this to dry I melt out the wax, and flux and solder with 18 k., using the cast as a sort of soldering block. In this way I am sure the parts when assembled in the mouth will be exactly right.

Everything being properly polished, with all sharp points or rough places removed, with the tubes through which the screws are to pass bevelled on the inner edge of each, etc., we are now ready to cement to place in the mouth. I cement but one part at a time where there are several, putting in the removable pieces as I go along, so that I may feel sure I have them in the same relative positions they were on the model on which they were constructed. These two steps of soldering and cementing should be most thoroughly done, for you will find in one or the other the chief cause of any annoyance you may be put to later by the patient's coming in at your busiest time with the appliance broken off. In cementing bands one should dry the teeth with alcohol, then apply cement with a thin spatula all around the teeth as well as to the inside of the bands. The purpose of thus applying the cement around the teeth is that when the bands are forced to place excess cement will be carried toward the gums and fill all spaces. I frequently allow this excess to remain until the next day, the better to protect the cement under the bands from the

saliva. After the cement has thoroughly set I apply only enough force or tension to hold all parts together until the next day, when I tighten until the patient notices a snug feeling which is, with a positive appliance, all that is necessary to move a tooth rapidly to position if all previous points have been carefully observed.

I will say but a few words as to the physiology of tooth movement. The process should be almost wholly physiological, the compression in front of a single moving tooth being only enough to produce a little irritation and induce the osteoclasts to begin absorption, and the tension on the membrane behind sufficient to cause the development of the osteoblasts for the formation of bony tissue to fill the space. Where many teeth adjoining are moved at one time the alveolar process seems to follow bodily.

I have the patient call as the case may require, but rarely at a stated hour. Only a few moments are necessary and we are each given more liberty than if a definite hour be named, and this to a general practitioner means much, for if he has given the time to the case in the beginning that I have he cannot afford to give much during the treatment. In fact, I have found it time saved over and over to follow this method when I can make appointments for the first sittings to suit myself rather than to save time there and be annoyed later. I always keep the original models of a case in progress in my cabinet and show them to the patient, to whom I have given a hand mirror that he may note the improvement. One can thus keep up his interest and enthusiasm and the patient's hearty cooperation makes the work a positive pleasure.

When the case is finished it is ready for the retaining appliance. This should be studied first from the original models and be made a retainer not only in name but in fact, whatever form is used. It should be as inconspicuous as possible, not interfering with speech or mastication, and be capable of being thoroughly cleansed, and should be worn long enough for the teeth to become absolutely stable in their new position. This time will vary from six weeks where one of the upper incisors is moved over the lowers for a child of ten, to six months for the same work for a patient from sixteen years old on, and from one to two years where the work has been extensive, as in reducing superior protrusion, expansion of the arches, etc. After putting the appliance on I have the patient call in a week to let me see that all is well, then in two weeks, then each month

afterward, while I carefully watch for any washing out of the cement or injury to other teeth. After removal of the appliance and a thorough cleansing of the teeth I follow the same plan for several months to see that no change occurs.

The patient should be urged to maintain thorough cleanliness and the use of an alkaline wash during all the time from the beginning until the retainer is removed, so that a minimum amount of harm may be done to any of the teeth.

I have simply outlined this supposed case and thrown in these remarks from the viewpoint, as I said in the beginning, of a country practitioner who is conscientiously convinced that it is his duty as a dentist to give the attention I do to this line of work. You all know the evils associated with irregularity—the appearance is marred, mastication is impaired, with all that it means, the speech is often affected, the gums are rendered unhealthy, and caries is induced. I may add to this that the very foundation of orthodontia is necessary to the general practitioner, even though he may never expect to undertake a case of regulating, not only because of the thorough knowledge of occlusion and contours thus gained for all his work, which will aid him in making fillings, crowns, bridges and plates, but in that greatest of all his functions, prophylaxis.

I should like to have limited this paper to the subject of prophylactic treatment in orthodontia, so thoroughly am I convinced almost every day of the necessity for it, but I believe such a paper would be better addressed to the parents of these little patients who present with their dental apparatus in such a sad state of neglect. However, since I cannot address them I can make a plea to you who must be their teachers to do all you can by instruction and proper attention when opportunity offers. Don't put these little sufferers, or sufferers to be, off because you are too busy. Secure more help and attend to them, and see what a reward will come to you in future years in dollars, in gratitude, in pride at what you have accomplished, and in serene enjoyment of duty well done. If you are not too busy (are all you young practitioners too busy?) I assure you there is nothing that will yield larger returns in building up a permanent practice than this very thing. Lastly, as general practitioners we should each know enough to treat a case intelligently or be honest enough to send it to some one who can.

Discussion. *Dr. E. K. Blair,* Waverly, Ill.: It is impossible for an up-to-date member of the profession to avoid this work unless he is located near a specialist. The greater the distance between the general practitioner and the orthodontist the more urgent is the demand for our services, as the expense and loss of time involved make it impossible for our patients to visit specialists in far-off cities. I look upon the work as a good practice builder with a most desirable class of patients, for it demonstrates clearly the ability of the operator to master difficult cases. Granting that the fee is inadequate, that the operator is often inconvenieced and annoyed, and that occasionally the value of the service rendered is underestimated, there still remains an imperative call to duty, for in justice to our patients malposed teeth must be brought into proper alignment, and in justice to ourselves the community must be taught the value of such service. Necessity has more than once been the mother of invention. Many of us, realizing that unless we did assume the responsibility the patients would remain disfigured for life, have ventured into the new field with gratifying and unexpected results. Like Dr. Barrett, my first work was partially with rubber bands, and while this was a crude method it was not altogether worthless. What seemed a few years ago almost impossible to perform may now be classed as thoroughly practical cases. The progress made in the last twenty years in orthodontia places the general practitioner upon a very different footing than formerly. We now have at our command many ready-made appliances that are marvels of mechanical ingenuity, beauty and usefulness, but this does not justify us in placing at a discount a thorough knowledge of how to construct any appliance we may need. The virtue in the manufactured articles is in the time and labor saved to the busy operator, uniformity in construction and perfection in details. Nevertheless, it is well for the dentist as far as possible to master the art of shaping his own appliances, for he who knows how to construct that which is needed to meet the requirements of the case in hand will best comprehend how to select the proper appliances from the manufactured product. Add to this knowledge a clear understanding of the pathological conditions to be encountered, of the physiological changes taking place in the mouth, and a thorough comprehension of the laws of occlusion, and the general practitioner may safely undertake any ordinary case. To me there is nothing so important as the study

of occlusion. We can move almost any malposed tooth in almost any direction, but to keep it where it should be necessitates a comprehensive knowledge of the laws of force which are applied so persistently in the mouth. Many an operation has been only a partial success because we have failed to include in our estimates this supreme factor. An absolute necessity in this work is models made from impressions with the greatest care at the outset of each case. They not only show the patient at the completion of the case the condition existing at the start, but help you to realize fully the forces to be contended with and the amount of work to be done.

Dr. W. A. Stevens, Chicago: The essayist made a very good point when he spoke of the parents coming with the child when the teeth are to be regulated. There is one thing, however, that cannot be settled by consultation, namely, the question of hereditary influence in the production of irregularities. If the jaw of one parent is large and the jaw of the other is small, there will usually be irregularity in the teeth of their offspring.

Dr. C. S. Case, Chicago: This is an excellent paper and I am pleased to hear such sentiments expressed by a busy general practitioner, because it shows that the whole profession has not gone daft over the teaching which has of late been extensively promulgated, namely, that there is a royal road, hitherto unknown, for the correction of irregularities of the teeth. To understand the secrets of this easily-trodden path you are told that you must first become thoroughly conversant with the great principles of occlusion, a knowledge of which, we are led to infer, is dependent upon an appreciation of some newly discovered laws which are too intricate and mysterious for the ordinary mind to grasp. Then you will be able to readily divide all irregularities of the teeth of whatever character into three simple classes. In fact, you are told that all irregularities naturally fall into these three classes, each one of which is characterized and determined by the mesio-distal occlusion of the first permanent molars. If this were a true and scientific method of classification the regulation of teeth would be a very simple and easily understood operation—an impression which it was no doubt intended to convey—but unfortunately it happens to be a fact that when irregularities are grouped in this way each class will necessarily contain malpositions and facial deformities that are widely and in some cases diametrically different from each other, requiring for

their correction movements, methods, and applications of force that bear no relation to each other. Therefore it cannot be said that they belong to a class, because they do not as a group contain the real objects of classification. But to proceed—when you have determined which one of these three classes your irregularity belongs in, all you need do is to purchase some molar clamp bands and so-called extension arches or bows, and simply pull or push the teeth into their proper positions, principally by means of brass wire ligatures. It is not even necessary, we are told, to band the front teeth if they do not require rotating, nor is it always necessary to even cement the molar clamp bands.

I can understand and fully appreciate the attraction which this sort of teaching would have for a busy dentist who would never attempt the regulation of teeth if he could get out of it, and especially upon that class of operators who wish to regulate teeth for the money there is in it, but who haven't the time, patience, or skill to properly drill themselves for the work. These men naturally grasp at any system which they are led to believe will simplify and shorten the operation. While it is always desirable to simplify the construction and adjustment of regulating apparatus, the attempt to use, because of their apparent simplicity, certain methods or appliances that do not in themselves fully present opportunities to meet special requirements of the case, greatly increases the complication and difficulties of the operator and often is the sole cause of failure. In fact, simplicity of treatments, ease and satisfaction in the management of regulating appliances with successful results are somewhat in proportion to the special adaptability and adequacy of the apparatus, however apparently complicated, and principally in proportion to the skill of the operator in making slight but important variations in its construction or adjustment, and to his ability to determine where, how and when to apply force, and especially when to stop, and change the whole or parts of the apparatus for methods or variations that will more perfectly meet the demands of the changing position.

The wave of teaching that has been sweeping over the profession during recent years—the origin and maintenance of which have come largely from commercial influences—and that has been eagerly grasped by dentists who desire to do regulating with the least possible trouble and interference with a general practice, has taught and

is still teaching the lesson—by many sad and bewildering experiences—that the regulation of teeth cannot be successfully accomplished by the purchase of a few stereotyped sets of appliances, even though, like patent medicines, they come highly recommended to cure all conditions.

In one sense this might be considered as having retarded the advancement of orthodontia, but I look upon it as a healthy evolutionary state tending towards its development to a higher plane where there will be a more perfect appreciation of its scope and possibility of treatment. I therefore hail with pleasure any paper which shows a true appreciation of the difficulties to be encountered, and the value of perfect band attachments, specially fitted and cemented to the teeth, and carrying adequate appliances, and making it possible to apply force in a scientific manner.

In some particulars, however, the essayist surrounds the practice of regulating teeth with certain ominous principles of procedure and technic methods that make these operations appear far more difficult than they really are. For instance, he lays great stress upon the necessity of first determining the cause of an irregularity before we can intelligently proceed with its correction. While I consider it of the most vital importance to fully understand the etiology of irregularities of the teeth, in order that we may be able to give advice, or to remove certain existing causes that are producing or will produce irregularities, and especially to avoid being the prime cause ourselves of irregularities by the injudicious extraction of deciduous or permanent teeth, we must remember that in almost every case we are called upon to treat conditions that exist, and that have been produced by a preexisting cause, difficult and often impossible to disclose, and that even when correctly determined can make no practical difference in our method of treatment.

Dr. Grafton Munroe, Springfield, Ill.: Science is classified knowledge, and the more thoroughly we classify irregularities of the teeth the more we approach science. As occlusion is an established law upon which we can base all our principles of orthodontia, and as these principles can be brought into scientific arrangement and thereby be classified, there is no reason why the classification should not be made. Any student of orthodontia knows that occlusion is its basal law, and the three divisions of the Angle classification are based on this law. Dr. Case makes some very useful instruments,

fine in technique and admirable in construction, and Dr. Angle does also. Both men have disciples, and some use one set of appliances while others employ something different. All come close to perfection by the use of these appliances, and they are certainly a boon to the dentist. They can be adjusted with a little manipulation and a blow-pipe. The construction of appliances in the schools has been receiving considerable attention of late, and all are giving orthodontia courses in their laboratories where formerly it was almost entirely ignored.

Dr. Case: I did not intend that my remarks should be considered as having any personal bearing, for in the main they apply to any one of a number of recent writers on orthodontia. However, as Dr. Munroe seems to think I have attacked Dr. Angle's classification of irregularities, I can do no more than defend my position by at least a partial explanation of my references. I fully appreciate and value the principles of occlusion in the regulation of teeth, but I do not differ in my opinion from any one of the prominent American authors on this subject or from any successful practitioner of orthodontia, which is to say that there has been nothing published in recent years of value that is new in relation to occlusion.

Dr. Angle, in a commendable effort to place the practice of orthodontia within the easy reach of all dentists, divides irregularities of the teeth into three principal classes. He uses for his standard of grouping the mesio-distal occlusion of the first permanent molars. In the first class he places all irregularities of whatever nature in which the molar occlusion is normal. In the second class are put all in which the lower first molars occlude distally to normal about the width of a bicuspid in relation to the upper molars, and in the third class he places all where the first lower molars occlude mesially in the same way. The first class must therefore include all the irregularities of a complex nature which do not materially affect facial contours. Of these may be mentioned intrusions and extrusions, open and short-bite irregularities, expanded and contracted arches, crowded, overlapping, and turned teeth, maleruption and poor alignment of one or more incisors, cuspids or bicuspids—in fact, every conceivable malposition which the teeth anterior to the molars will assume with the disto-mesial occlusion of the molars normal. Then why call them a class, unless we say they are a class of complex irregularities which bear no relation to each other in position or

needs or methods of correction? If this were all we might let it pass, but it happens that we must also place in this class three distinct varieties of facial deformities, two of which are so diametrically different from each other that I put them at the two extremes of all irregularities. I refer to full protrusions (of the upper and lower) and full retrusions. In both of these irregularities, whose position and method of correction are directly opposite, the occlusion of the molars and other teeth in their relation to each other may be normal. The three facial deformities that must be placed in this class, according to Dr. Angle's standard of grouping, are those in which the upper incisors are bodily retruded in relation to all the other teeth, and usually inlocked back of the lowers. The intermaxillary process in which the roots are imbedded is more or less undeveloped, the whole producing a decided depression of the entire upper lip and often the end of the nose. In this distinctive class of deformities, which demand a bodily protrusion of the upper incisors and intermaxillary process, the occlusion of the molars, bicuspids, and even the cuspids in their disto-mesial relation to the lowers will often be found normal. What I have said with regard to Dr. Angle's first class of irregularities may be taken as a fair sample of his second and third classes.

In my opinion the classification of irregularities of the teeth should be governed by the same laws that characterize classification in other sciences. This means the bringing together into groups recurring conditions or relations which bear the characteristic resemblance to each other. In irregularities a class should be composed of one general recurring malposition which admits of a similarity of didactic and operative treatment, or else there would be no advantage in classification to students, practitioners or teachers. To place in one class a variety of malpositions which bear no resemblance to each other in fact or in demands for correction is both unscientific and misleading.

RELIEVING PAIN.—(H. A. Cross, in *Review*).—The pain caused by setting a crown or bridge may be alleviated almost instantly by the free application of campho-phenique upon the gum.

THE MOUSTACHE.—(F. C. Noyes, in *Brief*).—To prevent the moustache from shutting out the light when not using the dam, take a strip of white muslin, an inch wide and three long, and draw the moustache back with it, fastening it with the dam-holder.

Digests.

PREDISPOSING FACTOR IN DENTAL CARIES. By Edward C. Kirk, D. D. S., Sc. D., Philadelphia. Read before the Ohio State Dental Society, December, 1902. In studying the problem of the etiology of dental caries from a historical point of view one is struck by the tenacity with which in one form or another the belief has been maintained that the causes of caries are wholly or in part internal to the tooth. The earliest records tend to show that this conception of the cause of caries was the original explanation offered of the disease. The writings of Celsus in the first century betray his belief in the theory that decay of the teeth is caused by worms acting from within outwardly, a belief which survives among the Chinese, Japanese and Hindoos at the present time, and which was undoubtedly held by them from a remote period antedating the writings of Celsus.

Later, the inflammatory theory, another aspect of the theory of internal origin, held sway, and even yet it is not wholly relinquished by some who have noted the reactions in the way of structural changes presented by the calcified tissue of the teeth undergoing carious action.

The modern studies of the etiology of dental caries began, strictly speaking, with the work of Leber and Rottenstein in 1867, when they published their important contribution entitled "Recherches sur la carie dentaire," followed by the paper of Underwood and Milles, presented to the Medical Congress of London in 1881, and were practically completed by the work of Miller, published in 1884. This group of brilliant scientific studies placed the active cause of dental caries before the world in its true light, and established the fact that so far as the exciting cause is concerned it is external to the tooth and a factor of its environment. The last remnant of foundation in support of an internal factor in the causation of dental caries would seem to have been destroyed by the published work of J. Leon Williams.

Attacking the problem from the standpoint of the physical characters of the hard structures of the tooth, Dr. G. V. Black, as the result of a long and painstaking research, felt justified in expressing the following conclusion: "Examinations of the density, of the percentage of lime salts, and of the strength of the teeth, that are

certainly reasonably accurate and include a sufficient number upon which to base trustworthy judgment, have shown that neither the density, nor the percentage of lime salts, nor the strength is in any degree a factor in predisposing the teeth to caries or in hindering its inception or progress."

Whatever may have been the differences of opinion upon minor points, the major conclusion of these papers as to the exciting cause of caries being a factor of the dental environment must be generally accepted as true. The total result of our knowledge developed from the splendid researches referred to is that we know to-day *how* teeth decay. The related problem *why* teeth decay is by no means as clear, for though we have a definite knowledge of the manner in which an infected environment may cause caries of the teeth, that fact alone is wholly inadequate as a means for solving the problem of prevention of dental caries.

There are certain well-known facts, the result of general clinical observation, which our present knowledge of the cause of dental caries fails to explain. First, the immunity of certain dentures from carious action and the extreme susceptibility of others to decay; second, the periodic oscillations in the conditions of susceptibility and immunity often observed in the same individual, and third, the tendency to a physiological oscillation in immunity from tooth decay noticeable in many individuals in passing from youth to old age.

Every dentist of some years' experience, and whose practice includes a number of families under continuous observation, has probably noted many instances of practically entire immunity from tooth decay, and it is reasonable to believe that the proportionate number of dental immunes is greater than those which come under professional observation—as they need no dental treatment, the dentist is not afforded an opportunity to examine them. Opposed to these cases of immunity we have those of extreme susceptibility in which, do what we will, the tooth structure melts away like snow before the noonday sun, and between these extremes are all grades and degrees of intensity of carious action.

Again, it is a commonly observed phenomenon, so common, in fact, that it has had a strong modifying influence upon methods of dental treatment, that many dentures which in early life manifest strong tendencies to decay will develop almost complete immunity as adult life is approached. This acquired immunity may become

permanent or there may be recurrences of susceptibility at irregular intervals apparently coincident with aberrations in the nutritional status of the individual, who is usually classed as one not having robust health. Finally, it is frequently observed that the susceptibility of childhood has been succeeded by an immunity extended through adult life to late maturity, but as old age approaches a marked recurrence of carious susceptibility follows, and if the teeth are not lost by alveolar disease they frequently succumb finally to caries.

I have endeavored merely to recall to your minds facts well known to you, as it is not my purpose to consider these peculiar oscillations in the carious process in detail. What does concern us in this connection is the fact that caries is a factor of tooth environment, and that the carious tendency varies not only as between individuals but shows equally marked variations in its intensity at different periods in the same individual. One fact illustrative of the variation in susceptibility to caries of the same individual, which has undoubtedly been noted by all present, is the frequent occurrence of so-called arrested decay, eburnification of the carious surface in connection with the first permanent molars. How often it is observed that these teeth have shown a tendency to rapid decay upon their morsal surfaces at the period of their eruption and continuing possibly five or six years thereafter, but gradually diminishing until it finally ceases; the exposed, darkly-stained dentin takes on a high polish like mahogany and the teeth are otherwise so sound and functionally satisfactory that we hesitate about placing a protecting contoured filling upon them. It has been customary to explain these cases of arrested caries of the teeth in question on the theory that, the decay being superficial and having destroyed the morsal surface evenly, a self-cleansing surface has been left which the triturating and detersive effect of mastication has protected from the lodgment of caries-producing bacteria, hence decay has been arrested. But we know that while certain surfaces of the teeth are by their form and position relatively immune from caries, yet in an infected and caries-producing environment no surface of any tooth is absolutely so, and we must seek further for an explanation of the arrested caries with eburnification of the dentin in the light of what scientific research has shown us to be the conditions which produce caries of the teeth. These facts are known to us as the result of special

bacteriological research, viz., first, that caries of the teeth is due in the first instance to the action of certain groups of microorganisms that cause acid fermentations, ending mainly in the production of lactic acid, which is a decalcifying agent; second, that these lactic-acid bacteria thrive best and for that matter almost exclusively in a carbohydrate medium; and third, that given a dental environment presenting the factors of the bacteria, the pabulum suited to their development, and proper temperature, moisture and aerobic conditions, decay of the teeth is practically certain to follow. We can conceive of but two methods by which under the conditions stated the carious process could be inhibited or prevented: First, by the withdrawal or elimination of one or more of the factors essential to the carious process, or second, by the introduction into the environment of some substance or condition which would seriously interfere with the functional activities of the bacteria concerned in the carious process. Upon one or the other of these hypotheses it would seem that we must depend for an explanation of these cases which are either naturally or by acquired characteristics immune from dental caries.

Our prophylactic treatment has thus far practically admitted these two hypotheses in the methods generally recommended and employed for combating the progress of dental caries. All the minutiæ of the dental toilet, the cleansing of tooth surfaces and the mucosa of the oral cavity are operations which to-day are known to be efficacious just in proportion as they eliminate bacteria and food debris, the two essential factors of the carious process; while the use of buccal antiseptics is a tacit recognition of the belief that some element inimical to the functional activities of caries-producing fungi may be introducted into the oral cavity and thus prevent the results which they are known to produce when permitted to develop unmolested. Both of these practical applications are defective in one important particular, viz., their action is temporary and they are effective only in proportion to the persistence with which they are exercised, while the persistence of bacterial influences, other things being equal, is a constant factor. Eventually then the constant factor of bacterial influence must produce its results when combated by the necessarily intermittent one of local hygienic and antiseptic means, the degree of success of the latter being relative only to its persistency. We must seek then for a means to prevent

the occurrence of caries and to combat its progress when the disease is manifest by some method equally as persistent as the disorder itself, a means which will so fundamentally alter the conditions essential to a caries-producing environment that the specific microorganisms of dental decay will be unable to thrive therein.

The conditions which in a strict sense produce susceptibility to dental caries are but little known, while those which enter into the problem of immunity are still less known. The researches of Miller make it very clear that the decomposition of carbohydrate food through the agency of bacteria is a prominent factor in the causation of dental caries, yet we have carbohydrate-food debris in mouths immune from caries and in mouths at the same time swarming with bacteria. Or again, in susceptible mouths no amount of careful cleansing or the use of buccal antiseptics will insure absolute freedom from carious attack. It would therefore seem to be clear that fermenting carbohydrate-food debris is not the only source of origin of the carious process. The periodic oscillations in susceptibility and the tendency of some as compared with the immunity of other individuals to dental caries points strongly if not inevitably to the conclusion that dental caries is a diathetic condition. That it is closely related to the processes of general bodily nutrition there can be no doubt, for upon no other grounds can we explain the variations in the rapidity and intensity of carious action in relation to variations in the health status of the individual so generally and frequently observed. We know, for example, that repeated pregnancies tend to induce decay in the dentures of many women, and that in wasting diseases, chronic dyspepsia and various forms of malnutrition the teeth suffer. The persistence of the impression made by the ancient error that tooth decay was a process somehow internal to the tooth has doubtless led us to feel that the interferences with bodily nutrition caused by disease are expressed as some alteration in the structure of the tooth that renders it more susceptible to caries. Since, however, scientific research has shown that the teeth are practically passive agents in the carious process and that the causes of caries are external to the tooth, our explanation of the manner in which pregnancy and intercurrent attacks of disease may influence susceptibility to caries must be found in the way these alterations in nutrition affect not the tooth but the environment of the tooth.

I have already called attention to the two only hypotheses upon which immunity from caries can in the light of your present knowledge be logically explained—by eliminating from the tooth environment some factor essential to the carious process or the introduction of some element inimical to the functional activities of caries-producing organisms. That both of these conditions may and probably do result from variations in the nutritional processes from time to time we have strong grounds for believing. We know that the fluid with which the teeth are constantly bathed, the mixed saliva, varies greatly in its composition, and thanks to the earnest and painstaking work of Dr. Michaels we are also in possession of the important generalization that the composition of saliva for the several diathetic states is fairly constant, and that as the nutrition of the individual varies from time to time so likewise does the composition of the saliva. Research in this direction has not yet progressed sufficiently far to furnish an adequate explanation of the whole question of susceptibility and immunity to dental caries, unless possibly we are to receive it in a communication from Prof. Miller which he has promised for publication in the *Cosmos* for January. (DENTAL DIGEST, June, 1903, p. 708.) But certain results have been obtained which are at least significant that the composition of saliva exerts the most important influence upon the causation of caries, and in connection with the nutritional changes which influence the composition of the mixed oral secretion we shall in due time discover the true predisposing factor of dental caries. In the examination of a considerable number of specimens of saliva which I have made I have found in all cases where caries was prevalent, but especially in the cases of children, the presence of a dissolved carbohydrate which responded to v. Jaksch's iodin test for glycogen or erythrodextrin. The finding of glycogen in the saliva has been previously reported by Salomon (Maly's Jahresbericht VIII 55, rep. 1879) and by Michaels (Trans. III. Congres Dentaire Internationale, Paris, 1900).

The close similarity of the color reaction which results from the action of the iodo-potassium iodid solution upon glycogen and erythrodextrin respectively suggests a possible error in the reported findings of glycogen in saliva, for the reason that the diastasic action of ptyalin upon starchy-food debris is known to produce among other serial products erythrodextrin, the reaction of which with the

iodin tests is scarcely distinguishable from that of glycogen. The significance of the presence of glycogen in this connection is of prime importance, for the reason that it represents a fermentable carbohydrate produced by the process of food metabolism and dialyzed from the blood plasma through the salivary or buccal mucus glands into the mouth cavity, and is therefore an index as it were to the character of the nutritional state. On the other hand, if the substance detected in the saliva by the iodin test be simply erythrodextrin, then it is not an index of the nutritional state, but merely evidence of the presence of a soluble carbohydrate, the product of mouth digestion.

The presence of glycogen in the saliva at times is highly probable, though in the abscence of a more characteristic test for that compound in the presence of erythrodextrin its presence in the mixed saliva cannot be taken as finally demonstrated. It would doubtless be possible to determine the question with sufficient accuracy by an examination of the saliva taken directly from the glands and before contact with carbohydrate-food debris in the mouth cavity was possible. That I have not as yet done, owing to the necessity for special arrangements for that line of work which I am not at present ready to take up. Certain physical characteristics of the saliva, its opalescence, for example, suggest in some cases the presence of glycogen, a suggestion further intensified by the chemical test referred to, and the strong probability that the predisposition to dental caries is correlated with and dependent upon a diathetic state make it appear not at all unlikely that some fermentable carbohydrate substance, such as glycogen, the product of food metabolism, is constantly dialyzed from the blood plasma into the mouth through the medium of the glandular apparatus of the buccal cavity in cases of marked susceptibility to dental caries.

The reaction of the saliva is of importance as a predisposing factor of dental caries. It is a well-known fact that the growth of many kinds of bacteria is profoundly influenced by the reaction of the culture medium, and until evidence to the contrary is forthcoming we are warranted in assuming that variations in the reaction of the oral fluids are not without modifying effect upon the progress of dental caries. My own tests of saliva in pronounced carious cases show a constant alkaline or neutral reaction of the saliva, and

where acidity of the secretion is manifested there is a tendency to arrest of the carious process with development of erosion.

In this connection let me call attention to the fact that these observed differences in the reaction of the saliva are characteristic of the secretion as it is poured into the mouth and are not necessarily the result of fermentive change afterward. Hence, if the reaction of the saliva has any modifying effect upon its suitability as a culture medium for the development of caries-producing fungi, we have additional evidence that the predisposition to dental caries is a factor of general nutrition, a diathetic condition dependent upon the processes of metabolism of food, for upon that process depends the reaction of the saliva.

Another fact which I desire to emphasize as the result of my studies of saliva is that we are probably in error when we ascribe all cavities found in the teeth to the action of caries. My reasons for making this assertion are based upon the microchemical examination of many salivas from the mouths of patients in which rapid dissolution of tooth structures was taking place. Notwithstanding the fact that all presented cavities affecting all of the tooth surfaces, a marked difference in the analytical results was observed, one class showing the existence of lactic-acid action and another the action of sodium acid phosphate upon the tooth structure with little or no lactic-acid action.

It is evident that where tooth dissolution from any cause is progressing rapidly through acid action we should naturally expect to find the salts produced by action of the acid solvent upon the tooth dissolved in the oral fluids, and such is the case. Thanks to the technique of microscopic and micropolariscopic analysis which has been given to us by Michaels, we are able to determine with accuracy the existence in the saliva of those salts which are the end products of acid action upon tooth structure, whether the acids be produced by lactic fermentation or due to the acidity of the saliva as a result of faulty metabolism in the process of nutrition.

Applying this method to the study of cases which clinically are denominated cases of rapid caries, it was soon discovered that in certain individuals little or no evidence of lactates of the tooth bases was to be found in the saliva, but instead an excessive amount of sodium dihydrogen phosphate and the calcium salt which it produces by action upon the tooth. These latter cases are then, strictly speak-

ing, cases of rapid erosion due to faulty metabolism and are not true caries at all, although presenting clinical appearances not unlike caries, resulting in cavity formation and gradual extension of margins until the whole tooth crown is nearly or quite involved. Investigation of the food habit and mode of life of those individuals presenting the acid saliva and the form of tooth dissolution referred to revealed the fact that they were addicted to the excessive use of carbohydrate foods, using large quantities of sweets and a minimum proportion of proteids and albuminoids; they were also of sedentary or inactive temperament and disinclined to physical exertion or exercise.

It therefore seems clear, in view of the abnormal existence of sodium acid phosphate in the saliva in these cases, that the metabolic processes in these individuals are characterized in general by an insufficient oxidation of the carbohydrate pabulum taken into the body, leading to an overproduction of carbon dioxid as compared with the intake of oxygen. The surplus of carbon dioxid is dammed back, as it were, on the blood, replacing oxygen in the hemoglobin, with the extreme probability that the cells of the buccal mucus glands are under these abnormal conditions of nutrition stimulated to the performance of that function which is normal to the renal epithelium, viz., the conversion of neutral sodium phosphate into acid sodium phosphate through the mass action of carbonic acid, the acid exudate being in the case of the buccal mucus glands thrown out into the mouth to work out its destructive effect upon the teeth.

Another aspect of the question under consideration will bring me to the conclusion of this communication, viz., the part which natural selection may play in the predisposition to dental caries. If we expose to the atmosphere under the same conditions two vessels, one containing fruit juice, for example, and the other a proteid substance like blood or meat infusion, both will in the course of time undergo decomposition, but the end products will in each case be totally different, the first will ferment and the process of decomposition will terminate in products acid in reaction, while the second will purify and its decomposition will terminate in products alkaline in reaction. But both were subjected to precisely the same sources of mixed infection and we must therefore conclude that in each instance only those bacteria survived which found in

the two substances respectively the sort of pabulum best adapted to their life needs.

We have in this fact, it seems to me, the illustration of a principle, viz., that the composition of the culture medium acts passively through natural selection as a powerful agency in determining the character of bacterial infection and growth. Applying this principle to the problem of predisposition to dental caries, it seems to me obvious that as the composition of the saliva is known to vary in relation to nutritional states, we are again forced to the conclusion that the predisposing factor in dental caries is a diathetic question, and that true prophylaxis can be achieved only by a profound study of nutrition and of those modifications in the nutritional process which so alter the composition of the oral fluids as to make them unsuitable for the propagation of caries-producing fungi—in short, to comprehend those nutritional conditions which produce immunity.

I am by no means unmindful of the importance of the recent researches of bacteriologists who have been concerned with the study of immunity from infectious diseases in general, more especially the magnificent work of Metchnikoff and Ehrlich, and it is not at all improbable that it may be found that the saliva of carious immunes contains defensive proteids which prevent the action of lactic-acid organisms upon tooth structure in those cases, but again it is evident that if the explanation of immunity from caries is to be found in Ehrlich's hypotheses, both susceptibility and immunity are still factors of nutrition, so that from any viewpoint with our present knowledge we are driven back to the conclusion that the predisposing factor in dental caries is diathetic, and that local treatment alone is inadequate to arrest its ravages.—*Register.*

ASEPSIS AND THE STERILIZATION OF INSTRUMENTS. By Samuel A. Hopkins, M.D., D.D.S., Boston. Read before the Harvard Odontological Society, November 20, 1902, and before the American Academy of Dental Science, February 4, 1903. To practice aseptic dentistry is impracticable if not impossible, but to sterilize instruments after using requires no especial knowledge or skill. It does, however, call for moral backbone and for character of the highest type. The practice of dentistry has always called for the exercise of extraordinary strength of character and honesty of pur-

pose, for the patient is almost at the mercy of the operator and can have but the slightest understanding of how well or how badly he does his work. A plausible liar can fool his patients for years, but he doesn't like to meet members of his own profession, and generally stays away from dental society meetings, lest his dishonesty be discovered. A high moral standard has always been an essential to dental practice, but never has the advice of Polonius, "To thine own self be true," been more applicable to the dental profession than since the advent of bacteriology made the sterilization of instruments a responsibility from which we have no right to shrink.

We know—have known for years—all about the sterilization of instruments. We have known for years of the possibility of transmitting the germs of syphilis, of tuberculosis, and of other diseases by means of unclean instruments. We have known of the ease with which pus-producing forms can be carried on the mouth mirror and instruments and by the hands. We know that the cotton with which we have wiped out an abscess or which we have taken out of a suppurating tooth is often left on the table or falls upon the floor, and we know that in its meshes are perhaps millions of staphylococci, and perhaps streptococci, capable of giving rise under suitable conditions to abscesses of a serious nature. We need not be told that the mouth mirror in our examining-room should be sterilized whenever it comes out of a patient's mouth and before it is used for the next examination. Our conscience pricks us every time we rinse it off and wipe it, and say, "I guess that's clean," for we know that we have taken a chance of introducing some germ into the patient's mouth that was not there before. All this knowledge has become so familiar that we deem it almost commonplace.

Most of us long ago accepted the germ theory of disease. We have firm faith in the doctrine that many diseases are occasioned by living microorganisms that usually find their way into the body through the mouth. Even the most rigid and skeptical homeopathist (whose principles we respect, though we may not accept them), even the most ardent Christian Science crank, prefers aseptic surgery to a surgical operation performed amid filthy surroundings and with unclean instruments. And this preference he can scarcely show without admitting that bacteria are the exciters of disease.

How comes it, then, that a large body of educated men, many of whom have received special instruction in bacteriology, should

be careless in their application of asepsis to their professional work? How is it that a body of men who probably put forth more conscientious, painstaking labor in the course of the average day than any class of men in the community should fail to include in their high moral code a practical plan for the sterilization of instruments?

How is it possible for a man with well-developed moral fibre, such as most dentists possess, who is honest in every detail of his work, who is constantly sacrificing his own convenience and giving his strength and health for the good of mankind—how is it possible, I say, for such a man, knowing what bacteria are, how they may be transmitted, and what evils they may produce, and knowing, too, how to prevent these evil results—how is it possible for any dentist to neglect any precaution that will protect his patient from the remotest possibility of infection?

It does seem strange that there should be a single dentist left who does not take the precaution necessary to protect absolutely his patients against contamination, but I am afraid we must admit that many of us are guilty of occasional sins of omission. You have only to watch a clinic at any dental society meeting to see an illustration of my meaning. Usually at such meetings there are no wash-bowls provided where a man may wash his hands. Mouth-mirrors are carried in the waistcoat pocket, and are thrust from one mouth into another with no attempt at sterilization and only an attempt at ordinary cleanliness. The hands of the seeker after truth are thrust first into a mouth where a clever piece of bridgework is on exhibition, and with only the most rudimentary attempt at cleanliness proceed to examine a mouth afflicted by cancer.

The fact that the sterilization of instruments has not become general among dentists is, I think, pretty clearly shown by the fact that the most important dental societies in the State and in the country, when holding conventions and giving clinics, fail to provide means for even the ordinary cleansing of instruments, and leave the clinicians to depend on such antiseptics as they may have at hand.

Do not misunderstand me. I am not here to berate the profession or to bring accusations of neglect of duty. I am trying to picture the condition of affairs as I see it to-day in many schools, in many offices, and in the public clinics given by our dental societies. Let use be honest with ourselves and admit that the picture is not greatly overdrawn, and let us seek the explanation. The average dentist

is an eminently practical person. Show him a way by which he can improve the condition of his patient's mouth, and no consideration of self and no thought of the trouble involved will prevent his adopting that method. He is so intensely practical that there is danger of his becoming empirical.

In the matter of asepsis the busy dentist has many excuses for not being greatly impressed by the necessity for sterilizing his instruments, and when all things are considered it must be confessed that the number of known cases where infection has been carried by dental instruments is comparatively small. We know that, so far as septic infection is concerned, the mouth, owing to its enormous blood-supply and the abundance of leucocytes in the tissues, is more resistant than any other part of the body. This is not due, as many suppose, to any antiseptic property contained in the saliva itself. There may and probably do exist in the mouth-secretions many nonpathogenic bacteria that excite the leucocytes to action, and in this way protect wounds from pathogenic or pyogenic microorganisms. This probably explains why animals lick their wounds. Human saliva when sterilized not only has little retarding action on bacteria, but acts as a very good culture medium for many forms. If it has any power to protect against the inroads of disease, that power lies in the nonpathogenic bacteria which it contains.

We have been accustomed for generations to perform and to see performed operations in the mouth which if undertaken in any other part of the body without aseptic precautions would result in abscess, septicemia, or lock-jaw. Suppose you made such a wound in the foot, leg, or arm as is ordinarily made in the mouth by the extraction of three or four teeth, what would become of the patient if it were allowed to fill up with all sorts of foreign matter and remained untreated? It would naturally result in an unprecedented boom in cemetery lots. Yet we see these great excavations in the mouth, ragged edges of gum tissue, fractured alveolar process, all caused by the extraction of a tooth, and all healing without the slightest treatment or the least suggestion of cautionary measures. Food particles fill up the wound; armies of bacteria flourish, multiply, and die; all the fluids of the mouth find their way in and assist in maintaining an active process of fermentation or putrefaction; and yet, even in the filthiest mouth after extraction by the filthiest dentist using the

filthiest instruments, we are bound to confess that serious results seldom follow such operations.

I am not pleading for lack of cleanliness, but I wish to be fair and to show why dentistry has not pinned its faith to aseptic operations as surgery is obliged to do. We have not felt the necessity, and we are practical enough to know that the risk isn't really very great if we don't strictly sterilize our instruments after each patient. We know, too, even if it has not been carefully explained to us, that the great safeguard against bacteria, the impenetrable wall against which the germs of disease may dash themselves in vain, is sound, healthy, and unbroken epithelial tissue. Whether it be in the mouth or upon the surface of the body, healthy epithelial tissue forms an impassable barrier to all forms of bacteria. We know, however, that while this is a safeguard to be trusted it is not to be fooled with, for we know that blood-poisoning frequently follows a wound too small to have been noticed, nor can we ever be sure that in the mouth the epithelial covering is not broken or congested and ready for the admission of bacteria.

Surgeons have been known time and time again, in the frenzy of their devotion to the scrubbing-brush, to so scrub away and irritate the epithelium of their hands and arms as to invite the entrance of bacteria, and many septic fingers and arms, as well as general and fatal poisoning, have followed this vigorous but ill-judged adherence to the principles of aseptic surgery. This has resulted in the use of rubber gloves among surgeons to a certain extent. There are certain advantages and certain disadvantages in the use of the rubber gloves by surgeons, but for the dentist the gloves are hardly to be thought of except in dealing with a syphilitic or other infectious case. On the whole we have reason, I think, for believing that in view of the vast number of dental operations performed the evidence that can be gathered will hardly show any great number of cases wherein disease has been carried by dental instruments, and it is for this reason, and for the other reasons I have alluded to, that the practical dentist has not shown an active interest in the lessons bacteriology teaches, and has failed to sieze with avidity the idea of absolute protection to his patient by means of sterilized implements of practice.

Nevertheless, the idea demands our respect, and the knowledge we have acquired in the past twenty years in relation to the transmission of disease by bacteria places upon us a responsibility so grave, so

sacred, that to neglect it is scarcely less reprehensible than to become a contributing party in a case of manslaughter. Do not let us shirk this responsibility, but let us face it with the will and power which have characterized all advances in this profession. You know and I know that the fact that infection by means of dental instruments is unusual should not enter into this question at all. In England, where chloroform is used as an anesthetic, it has been estimated that one life is lost in every five thousand cases operated on. We can conceive of circumstances where, knowing this danger, it would be good judgment to use chloroform, as, for instance, in operating at night, when the danger of setting fire to ether must be considered, or in cases where the retching and vomiting following ether would endanger the success of the operation. We can easily justify such a risk and continue to confide in the judgment of the surgeon in spite of fatal consequences. On the other hand, suppose the risk of fatal consequences in using an unclean—and by that I mean an unsterilized —knife was only one in ten thousand; I am not sure that the actual risk is greater; but would any one condone a surgeon's action in using such an instrument when boiling water and other means of sterilization are to be had for the asking? Have we not a right, in view of our present knowledge of bacteriology, to regard the surgeon guilty of manslaughter who contributes to the death of a patient by using an unsterilized knife? Let us bring this home to ourselves. Can we ever be sure in using an unsterilized instrument that we are not conveying a disease germ to our patient's mouth, and can we be sure that the germ so conveyed will not find the conditions ripe for its development and for the propagation of disease?

I have recently completed some experiments upon the micrococcus tetragenus, the staphylococcus pyogenes aureus, and the micrococcus lanceolatus or croupous pneumonia germ, which show beyond question that these forms vary greatly in their virulence in different mouths. These experiments bear on the question of sterilizing instruments in this way: It can be fairly inferred that a bacterium which is quite inactive and harmless in one mouth might when transferred to another find conditions which would cause it to become exceedingly virulent and a menace to health. Moreover, the dental profession has with few dissenting voices accepted Miller's theory of the bacterial origin of caries. At present we do not attribute the formation of lactic acid to a particular microorganism. I

have isolated sixteen different forms from the mouth, capable under favorable conditions of producing this acid, and it is said that there are not less than a hundred forms of bacteria in existence that have this interesting property. We cannot tell as yet what forms would be active in one mouth and what would be active in another, but we are reasonably sure that in excavating a carious tooth preparatory to filling our instrument has come in contact with some form that might give rise to caries if transferred to another mouth. Are we then justified in taking the risk of introducing that microorganism into the mouth of our next patient by a failure to sterilize that instrument?

Besides the common mouth forms, besides the lactic-acid-producing forms, we know that the germs of nearly all diseases enter the system through the mouth. They come with food, water, air, and from the fingers thrust into the mouth. I fancy it is true that disease germs are generally harmless, and I mean by that it is probable that most of us have again and again in our lives taken in the germs of typhoid or some other serious disease, and yet, because the system was not in a condition to be affected, or because the culture material was not right for its development, it died out without producing the disease. Yet in spite of this immunity (upon which we can only speculate, since we have no way of determining) we decline to receive disease germs into the system if we can by any reasonable means avoid them, and if the sterilization of dental instruments will in any way lessen the possibility of transmitting disease we have no longer an excuse for declining to take this trouble.

Now, as to how to sterilize the instruments. The methods are simple and familiar. If we once accept the responsibility and go about it with the determination to do our duty there will be no difficulty about ways and means. You cannot improve much over boiling in water to which a pinch of washing soda has been added to prevent rusting. Fifteen minutes will destroy any bacterium likely to be found in the mouth. It will not, however, always destroy spores, which are extremely resistant to heat and to chemical agents. Still, I think we may ignore spores for two reasons: in the first place they are developed only on old culture media after the chief ingredients which nourish the microscopic plants have been exhausted from the soil, and in the mouth we have few such conditions, as the soil or culture medium in the mouth is constantly being renewed, and

there is unceasing activity of growth, which precludes the likelihood of spores being developed; second, the coccus forms which predominate in the mouth do not produce spores. If spores develop it will generally be because the instrument has been laid away for several days before sterilizing.

Boiling water will effectually sterilize dental instruments. There are, however, many dental implements which cannot without injury be submitted to boiling water, but these can be sterilized quickly and effectually in a formalin oven. The Schering formalin sterilizer and lamp are probably familiar to you all. If you wish me to be accurate, I will say that in experiments which I have made instruments kept in the oven for ten minutes, with three small or one large pastile burning, showed no growth at the end of twenty-four hours when placed in bouillon tubes, a slight growth was noticed at the end of forty-eight hours. Similar instruments not sterilized showed distinct growth in twelve hours, and profuse growth of many varieties in twenty-four hours. Instruments kept in the oven for fifteen minutes showed no growth. Fifteen minutes may therefore be considered effectual.

One thing is to be said about the use of formalin—the instruments should be both clean and dry before being put in the oven. By clean I mean that there should be no dried blood, bits of carious tooth, or other unclean substances on the instruments, since the formalin gas will not penetrate deeply nor will it prove effective on wet surfaces. If you use formalin the best way to manage is to have the formalin oven in your office. You have a perfect right to inspire confidence in your patient by doing the sterilizing under his eyes. It is a good way to make public opinion. When our patients refuse to patronize a man who is untidy and who does not sterilize his instruments the reform in dental practice will come quickly. When you have dismissed a patient, give the instruments to a trusty servant to wash and wipe dry, and then put them into the sterilizer. It is better not to leave the lamp burning longer than is necessary to convert the pastile into gas, as the heat generates moisture, and there will be a sweating process which will rust the instruments and the oven as well. Often this is unavoidable and there is a deposit on the instruments resembling dust, which must be wiped off with a sterile napkin.

It is a good plan to have boiling water also in your office. A shelf

can be constructed sufficiently high to be out of the way of small children, and a Bunsen burner, connected with the neighboring gas-jet, a lamp, or an electric heater, as the case may be, placed on this shelf, and over this a pot of boiling water may stand all day and the instruments be placed in it. It is better, for convenience in handling, to have a wire basket with a solid bottom, and to place the instruments in this. The basket can be placed in the boiling water and removed with little inconvenience and no danger of burning the fingers. It is more convenient to have both methods at hand and there is scarcely any expense attached to either. The office itself should be well sterilized from time to time, and this may be done by burning formalin. You close the windows tightly, pull out the drawers of your instrument case, put a half-dozen pastiles in the cup of the lamp, light the lamp, close the door, plug up the key-hole, and leave it until the following morning. You will find an odor of formalin and your eyes and nose will tingle when you first enter the room, but five minutes with an open window will remove the odor, and the place will be wholesome, sweet, and sterile. I have tried any number of experiments to prove the efficacy of this method of sterilization, and I can assure you it is most effective for superficial sterilization. At the Medical School I had a room to work in that contained about eight hundred cubic feet of space. Three or four fresh formalin pastiles would render the place so sterile that the dust on the shelves (and the place was covered with dust) could be brushed into a tube of bouillon and the tube set in the incubator without any growth showing itself.

The need for general office sterilization arises because the fingers in picking up an instrument from the cabinet or tray may come in contact with other instruments, things will drop on the floor, and the air of the room is likely to become contaminated. You are sure of clean instruments and clean air if you sterilize your room every night, but you must always remember that formalin has not the power of penetration that it was once supposed to have and must be looked upon as a surface sterilizer. For this reason the instruments should be washed and dried first. This is especially true of burs and files. The hands cannot be rendered absolutely sterile without an expenditure of time and trouble which is out of all proportion to the necessities of the case, but they may be rendered practically sterile by the use of permanganate of potash, or better still by a new prepara-

tion called sublamin. It is an ethylenediamin-sulphate of mercury, about as powerful as the corrosive sublimate, but does not irritate the hands. It dissolves well in water, can be used with soapsuds, which is not true of the sublimate, penetrates deeper, and leaves the hands smooth. After infective material has touched the hands they should always be washed in sublamin.

We may as well give up the idea of strictly aseptic dental operations, because we cannot possibly sterilize the mouth, and the moment an instrument enters it becomes contaminated. The public, however, has a right to expect security against the mouth bacteria of others. Our patients are only reasonable in demanding that they be not exposed to the germs contained in the mouth of the patient that preceded them, and it is our business to insure them this immunity, but to practice aseptic mouth dentistry or surgery is often beyond the limit of our skill. I know of no method of destroying the bacteria in the mouth that will not also destroy the patient. I say this soberly after years of experimentation. I continue to use antiseptics in all cases where suppuration occurs, and am convinced that they do an immense amount of good, but I have never been able to keep a mouth in a strictly aseptic condition for ten minutes at a time, and for our purposes it is not necessary nor am I sure that it is altogether desirable that the mouth should ever be sterile. For the ordinary operations in dentistry our responsibility ends when we have given a definite assurance that we are not conveying to the mouth of any patient a bacterium that was not there before. For surgery and for extractions we will naturally take all the precautions possible to lessen the danger of infection from germs that exist in the patient's own mouth, and here we may gain much from the use of suitable antiseptics.

I am proud to be able to say that in both of the dental schools in Boston effective measures are taken for the sterilization of instruments, and every boy in these schools has impressed upon him the necessity for thoroughness in this particular. As soon as the necessity is generally appreciated public opinion will demand in no uncertain voice protection at our hands, and the laggard dentist who is content to take his chances will find himself supplanted by those young men from our schools who understand their moral responsibility and have backbone and determination enough to practice with clean implements, clean hands, and a clean conscience.—*International.*

EXPERIMENTS IN VULCANITE TO TEST CONTRACTION AND WARPAGE. By Stewart J. Spence, D.D.S., Chattanooga, Tenn. *Experiment 1.* To test whether vulcanite contracts or expands in cooling, red rubber was rammed into a glass cylinder and then vulcanized. *Result:* The plug was quite loose in the cylinder. Vulcanite contracts.

Experiment 2. The glass cylinder being found inapt for measuring the extent of contraction, the following device was employed: Of common tinned sheet iron was made a little box in size 3x½x½ inches, into which was packed red rubber, which was vulcanized. *Result:* The strip of vulcanite came out slightly contracted, so that two thicknesses of paper could be inserted between it and the end of the box, this being about 0.15 millimeter of space. But suspecting that contraction had not been free and uncontrolled, because extruding portions of the rubber had become entangled with the wire which had bound the lid on the box, there was made:

Experiment 3. The above-mentioned strip of vulcanite was filed down so that it would lie loose in the box and together they were again run through the vulcanizer at 320° F. for an hour and a quarter. *Result:* The space between vulcanite and box, at their ends, was increased to 1.5 millimeters, about one-sixteenth of an inch. This astonishing result made it evident that were it not for the restraining effect of the plaster investment, every vulcanite plate would contract so as to be utterly unwearable. To test the effect of a powerful restraint there was made:

Experiment 4. The iron box was again packed full of red rubber, in which was embedded a serrated bar of iridiumoid, and the case was vulcanized for two and one-half hours at 300°. *Result:* No contraction. Then it was again vulcanized at 300° for two and one-half hours; again at 315° for one hour; at 320° for one hour, and lastly at 330° for one hour, by which time it showed a very slight contraction, about 0.3 millimeter. Had the bar extended the full length of the rubber, probably there would have been no space at all. This experiment proved that the contraction of vulcanite can be prevented.

Experiment 5. To determine at what degree of heat this contraction of vulcanite commences, and also by what degrees it progresses, red rubber was packed in the metal box, slightly overflowing it so that some rubber would extrude and thus prevent shrinkage

during the first vulcanization, and this was put through the vulcanizer for one hour at 320°. *Result:* It came out, as expected, showing very little contraction, about one thickness of paper of space. It was then placed in heated water, the temperature of which was gradually raised as follows:

120° for five minutes.	No increase of space.
130° " " "	Almost imperceptible increase.
140° " " "	Space of two folds of paper.
150° " " "	Space of three folds of paper.
160° " " "	Space of four to five folds of paper.
170° " " "	Space of seven to eight folds of paper.
212° for one-half minute.	Space of fourteen folds of paper.
212° for five minutes.	Increase slight, if any.

As fourteen folds of this paper measured about 1.0 millimeter, the shrinkage of three inches of vulcanite at boiling heat was seen to be about 1.0 millimeter. The writer believes that this experiment affords valuable data for the reduction of the size of overlarge vulcanite plates. He recommends the immersion of the plate in water at 140° for about a half minute, then trial in the mouth; if gain has come repeat the attempt at 150°, and so on till increase of adhesion ceases. The passing beyond the point of strongest adhesion if but slight need not be dreaded, for the absorption of the ridge under the undue pressure thus induced will soon equalize the pressure to the palate.

As a continuation of this series of experiments the vulcanite strip was placed in the vulcanizer and results were as follows:

300° for five minutes.	Total space,	1.5	millimeters.
300° for sixty minutes.	" "	1.8	"
315° " " "	" "	2.0	"
320° " " "	" "	2.4	"
320° " " "	" "	2.5	"
320° " " "	" "	2.7	"
320° " " "	" "	1.5	"
320° " " "	" "	1.0	"

Thus contraction increased until by the sixth vulcanization it had reached the enormous extent of 2.7 millimeters! After that expansion set in.

Experiment 6. To determine if other rubbers would act like the

red rubber used in experiment 5, into four boxes of tinned iron, each about 3x¼x¼ inches, were packed respectively black rubber, weighted rubber and two kinds of red. The black was the uncolored variety, not the jet black. These were vulcanized for two and one-half hours at 300° F., and when opened and freed by filing from the extruding portions which, as previously explained, prevent contraction at first vulcanization, were revulcanized for another two and one-half hours at 300°. *Result:*

Weighted showed space of 0.8 millimeter.
Black showed space of 1.2 millimeter.
Red (a) showed space of 1.2 millimeter.
Red (b) showed space of 1.4 millimeter.

Contrary to expectation, the black rubber showed less contraction than the more adulterated red rubbers. These pieces were again vulcanized, this time at 315° for an hour. *Result:*

Weighted showed space of 0.9 millimeter.
Black showed space of 1.2 millimeter.
Red (a) showed space of 1.4 millimeter.
Red (b) showed space of 1.8 millimeter.

Again they were subjected to the vulcanizer at same time and heat. *Result:*

Weighted showed space of 0.9 millimeter.
Black showed space of 1.5 millimeter.
Red (a) showed space of 1.4 millimeter.
Red (b) showed space of 1.8 millimeter.

Thus all except the black had now come to a standstill. They were once more put through the vulcanizer, this time for one hour at 330°, when instead of further contraction, they all underwent expansion.

Weighted showed space of 0.5 millimeter.
Black showed space of 1.3 millimeter.
Red (a) showed expansion of 4.0 millimeter.
Red (b) showed space of 1.4 millimeter.

The enormous expansion of Red (a) (three millimeters beyond the length of the box) was quite phenomenal. As, however, it had been placed in the vulcanizer loose (that is, not in its metal box), and as some plaster casts had been put in at the same time, it may have been pressed upon by these casts, which doubtless would increase its length.

Two of these four strips of vulcanite were again treated to 330° for three hours. *Result:*

Weighted showed space of 0.3 millimeter.
Red (b) showed space of 0.0 millimeter.

The weighted rubber, as we see, expanded less and also contracted less than the others. These expanded strips presented a swollen appearance, their previously flat surfaces having become spheroidal. On being broken open they were found honeycombed. It became an interesting question: Will a plate which has been vulcanized at a certain heat contract any further if revulcanized at the same, or a lower, heat? To test this was made:

Experiment 7. Red rubber was packed into one of the beforementioned boxes and vulcanized at the high heat of 330° for the long time of three hours, with a resulting contraction of 0.8 millimeters. It was then revulcanized at the lower temperature of 320° for one hour with the result that the contraction increased to 1.4 millimeters. It was thus demonstrated that revulcanization at even a lower temperature may produce further shrinkage.

The fact that vulcanite contracts during cooling being thus demonstrated, it follows that warpage of vulcanite plates is caused by unequal contraction, as where the controlling hold of the plaster investment at one side of the plate is stronger than on the other. Therefore warpage may be said to result from unequally resisted contraction. That it does not result from a mere tendency to curl up, such as may be seen when a piece of rubber is placed on a hot stove, is made evident by the two following tests:

Experiment 8. A sheet of red rubber, two by two inches, was vulcanized between two plates of glass, which were feebly held together by a weak elastic band. *Result:* After vulcanization this band was found so much softened that it exerted no pressure whatever on the plates of glass, and yet they remained in close contact with the vulcanite.

Experiment 9. While conducting experiment 5 the strip of vulcanite there used was found slightly bowed up after coming out of the water at 170°. A small elastic band was slipped around it and its box, exerting a very slight pressure on the bowed portion. It was then replaced in the hot water, and soon the bowing disappeared. These two experiments seem to prove that any investment

of plaster, if not absolutely mushy, will control the warpage of vulcanite that arises from other causes than contraction.

Experiment 10. Vulcanite expands temporarily under heat. One of the before-mentioned strips, having about 1.3 millimeters contraction, was with its metal box placed over an alcohol flame on a metal slab (an old die-plate for swaging crowns, rescued for the occasion from the innocuous desuetude to which it was long ago relegated) on which was also placed a thermometer. *Result:* When the heat had reached 320° the strip of vulcanite had expanded to its original length. On cooling it retracted. This experiment indicates that the contraction of vulcanite occurs during cooling, not during vulcanization.

Experiment 11. That vulcanite can be stretched when heated was shown thus: A strip of vulcanite was placed on the above-mentioned slab over an alcohol flame, and when warm enough to be pliable was placed on at both ends. *Result:* Its length was increased 3.0 millimeters.

Experiment 12. Let us now pass on to experiments made on plates. A cast was made with non-expansive plaster of a black rubber gum-block full upper plate, vulcanized about sixteen years ago. This cast was separated from the plate, and the latter was immersed in boiling water for five minutes. The question was, how much would it contract? *Result:* On replacing the plate on the cast it was only with difficulty that it could be pressed home, and when so pressed there was a space between plaster and plate which admitted thirty-six folds of No. 20 tinfoil. This would of course ruin the fit of any plate ever made. Besides this cast, another means was employed for testing the degree of shrinkage. A bar of steel, three inches long, was pointed at its ends, which were then bent at right angles to its shank. With this little instrument, as with a pair of dividers, marks were scratched on the vulcanite, both from heel to heel and from the posterior borders on the incisors. These showed that after its immersion in boiling water this plate had shrunk 1.5 millimeter from heel to heel, and 1.0 millimeter from back to front.

Let me here revert to an article by Dr. George B. Snow in Richardson's *Mechanical Dentistry.* He says: "The amount of shrinkage in vulcanite, from cooling after vulcanization, is not generally noticed and provided for as it should be. Plates composed of single teeth do not give trouble from this cause, but full plates on which

sections are mounted are often very vexatious from the change of shape they undergo. The contraction of the rubber has the effect of lessening the radius of the arch, drawing the heels of the plate together, thus rendering it a little too narrow to fit the mouth accurately. This has the further effect of elevating the palatal portion of the plate, which when tried in the mouth will usually be found to rock slightly. The shrinkage here alluded to becomes a more serious matter when the plate is revulcanized in course of repairing it. In cooling a second shrinkage takes place, and its fit, already defective, is made perceptibly worse." Dr. Snow then proceeds to the remedy, heating the plate, stretching it apart at the heels and pressing downward the palatal surface.

I quote these words partly to call attention to the truth which they contain, and partly to point out certain errors. These latter are, the supposition that only gum section plates contract and warp, and that contraction would throw the palate of the plate up. My experiments with both gum-blocks and single teeth plates indicate that both are liable to warp, the former somewhat worse than the latter. And it can easily be seen that the drawing towards each other of the ends of the arch will force upward its dome only when this drawing together is not caused by contraction of the whole arch; but when it is so caused the summit of the arch is of course reduced with the rest. Therefore to attempt to remedy the evil by heating the palatal portions and pressing downwards would only make bad matters worse. But if unequal resistance to contraction has occurred, that is, if the teeth on one side have been held more firmly by the plaster investment during cooling than those on the other, the contraction becomes uneven, resulting in warpage, one side of the plate dropping away from the ridge. That both these changes of shape (contraction and warpage) occur whether in plates of plain or section teeth is shown by the following:

Experiment 13. Four old vulcanite plates were filled with non-expansive plaster, the resulting casts being then removed from the plates and laid aside to be used afterward for testing their changes. These plates were then further treated as follows: Plate I. This was a plain-tooth full denture on red vulcanite. It was invested with plaster of paris and then revulcanized at 320° for an hour and a quarter. *Result*: No warpage (that is, no uneven contraction), but contracted 0.8 millimeter from heel to heel, and when the above-

mentioned testing cast was placed in the plate the space at the dome admitted sixteen thicknesses of No. 20 tinfoil. Plate II. This was another plain-tooth full denture on red vulcanite. It was invested in a substitute for plaster of paris compounded by the writer, and then revulcanized simultaneously with the above. *Result*: A very slight warpage and contraction from heel to heel, only 0.2 millimeter. This better result with plate II was doubtless due to the superior strength of the investment. Plate III. This was a gum-block full denture on red rubber. It was filled with the above-mentioned hard-setting compound, but all the rest of its investment was of plaster of paris. Vulcanized at 320° for one and a quarter hours. *Result*: A decided warpage and more contraction than plate II. Perhaps the greater warpage of this than plate II was due, according to Dr. Snow's theory, to the unshrinking wall of porcelain gum. The absence of the hard-setting compound for investment accounts for the greater contraction. Plate IV. This was a gum-block full denture on black rubber. It was invested entirely in the compound, which, however, was not worked so as to obtain its greatest hardness. *Result*: The contraction from heel to heel was 0.5 millimeter and the space at dome admitted sixteen thicknesses of tinfoil. This was a bad showing. However, the palatal arch was exceptionally high, three-quarters of an inch above the ridge.

Experiment 14. In each of these four cases the investments had been hurried into the vulcanizer while "green" (newly set). To test the virtue of dried plaster, plate II was invested with plaster of paris and this was given a day to harden. *Result*: Plate came out of vulcanizer but little changed. The same plate was next reinvested in plaster of paris and vulcanized immediately. *Result*: Contraction from heel to heel was now increased to 0.6 millimeter (an increase of 0.4 millimeter), and one of the heels drooped 0.5 millimeter away from the ridge, and when the testing model was forced home the space at dome admitted twelve folds of the No. 20 tinfoil. This preaches loudly against the use of green investments, but unfortunately we cannot conveniently wait a day for investments to harden, especially with repairs.

Experiment 15. A new plate of gum-block teeth was made, a bar of serrated iridiumoid being imbedded in its rubber along its posterior border. After vulcanization a model in the non-expansive compound was taken of it, and it was next invested in the same ma-

terial and immediately placed in vulcanizer. *Result:* Contraction from heel to heel was almost imperceptible and warpage was very slight, the space at dome admitting only three folds of tinfoil; but the distance from back to front had decreased 0.25 millimeter, and there was a space of five folds of tin between cast and plate at the region immediately posterior to the rugæ. Here was a decided improvement, due largely to the metal bar. The slightly greater space back of the rugæ region would be no objection, affording a sort of relief chamber, but the decrease of a quarter of a millimeter in the postero-anterior direction is more serious. Doubtless this might largely be prevented by another serrated bar lying in that direction. I am impressed that it would be well to generally insert such bars in plates, especially the lower and the very thick, for our plate may go for repairs to some dentist who uses plaster of paris for investments, possibly green at that, and thus become contracted. But as these bars do not prevent contraction of all points of the plate, and as they do not generally exist in the plates coming to us for repair, it is desirable to have a way of preventing contraction by the investment.

Of course this can be done very perfectly by dry vulcanization, for in this method the investment does not soften. Indeed, this would overcome another evil of plaster of paris—the expansion of the model in vulcanization, and to a great extent its compression in flask-closing. But dry vulcanization is open to serious objections. However, for those who feel disposed to try it, I will say that it can best be done, so far as my experiments have taught me, by placing the flask in a little sand in a melting pot over a flame, with a thermometer passed through a hole in the upper lid of the flask and reaching down about half an inch into the investment, in which a hole has been made to receive it. This thermometer will need no watching until the mercury reaches the 212° mark, at which point it will stand until the moisture has passed off as steam, which usually requires about one and one-half hours; after which it must be carefully watched, and the heat must be turned down at about 270°, after which it will run up to 320° and perhaps further. Indeed, it is difficult to hold it steady at that point. As heat is very slowly conducted by dry plaster the lower part of a flask will be hotter than the upper, the lower parts of the plate will consequently be more vulcanized, and the lower portion of the model will be more contracted.

Experiment 16. An experiment to test the contraction of plaster of paris under dry heat was made thus: Into the lid of a vulcanizable rubber box, which measures, as we all know, about 6 x 3 x ¼ inches, was poured plaster of paris, filling it. This cast, removed from the lid, was then placed over a fire in a pot filled with sand, standing on one of its ends, and heated to about 300° F. for one hour. *Result*: This slab of plaster contracted over 2.0 millimeters at its hotter end and only about 0.5 millimeter at the cooler one. This proved that dry heat is conducted but poorly by either sand or plaster, and therefore that models subjected to it become warped by uneven contraction. Even if dry heat could be made to equally surround the flask it would most contract the portion of the model nearest the outside.

As these facts make dry vulcanization undesirable, the writer set to the task of perfecting the plaster compound in hardness, that is, in post-vulcanization hardness. He so far succeeded that in a test made by filling one-half of a flask with this compound and the other half with plaster of paris, the former showed a post-vulcanization hardness from eight to ten times greater than that of the other, as evidenced by a buckshot sinking almost its entire diameter into the plaster of paris when the two halves were closed upon it. With this material was then made:

Experiment 17. A full denture of gum-block teeth was mounted on wax and invested with this non-expansive, hard-setting plaster. No stiffening bar was used. After two hours the flask was opened and measurements were marked on the plaster with the little instrument previously described. These marks would be transferred to the rubber and so would indicate the contraction if any. *Result*: After vulcanization these measurements were found unaltered. Shrinkage had been fully controlled by the investment, though used "green."

Experiment 18. To test if the heat evolved in the operation of polishing is sufficient to cause contraction of a plate, this last-mentioned plate was polished on a lathe with revolving sandpaper, pumice or cork and wheel, and chalk, a testing cast of it having first been taken. *Result*: No change appeared. The heat evolved by polishing probably never reached 130°, at which, as we saw, contraction begins.

Experiment 19. This concerned the joints of the last-mentioned

plate and was conducted at the time it was being made (see experiment 17). After removing wax and before packing the rubber oxyphosphate of zinc was packed in the joints. Rubber was then dipped in a mixture of alcohol two parts, and benzine one part, which by partially dissolving the rubber makes it easy to pack but is apt to enter joints. Results were bad. The joints were dark with vulcanite. The plate was then broken up and these teeth were used for making another plate, in which the process differed only in the mode of packing the joints. After waxing up one incisor block and an opposite bicuspid block were removed, and the four joints thus exposed were packed with creamy cement. Results were excellent, one slight flaw only appearing. Again the plate was broken up and the same teeth reset. This time the joints were left unpacked, but the dissolving mixture was not used. Results were very good. The hard investment had prevented the spreading of the joints, and thus prevented the entrance of the rubber. (To produce very clean joints it is best after grinding to immerse them in nitric acid.)

Experiment 20. This last-mentioned plate was filled with non-expansive plaster and a cast taken of it. It was then immersed in water in various temperatures, commencing with 140° F. and rising to 212°. Its contraction was proven by the increasing difficulty experienced in fitting it to its testing cast. At boiling heat its contraction was 2.5 millimeters from heel to heel, and 0.9 millimeter from back to front. When pressed home on cast (which could be done only by warming it) it showed a space of 0.7 millimeter at dome.

Experiment 21. The last-mentioned plate thus contracted was treated till pliable, and then pressed home on its cast, a firm pressure being maintained at the palatal dome till cooled. *Result*: The above-mentioned space at dome disappeared. The heated vulcanite had stretched.

Summary. Let us now summarize the facts demonstrated by these experiments: Vulcanite contracts in cooling, even to as much as 2.8 millimeters in three inches; after fully contracting it expands and puffs after repeated vulcanizations. Both expansion and contraction are least with weighted rubber, and red and black are in this respect nearly alike; contraction is not completed at the first vulcanization, but may be increased by each successive vulcanization

up to four or six, and that even when the heat of these latter vulcanizations is less than that of the first; this contraction may be prevented by forcible means, such as a metal bar of sufficient strength, or an investment possessing sufficient post-vulcanization hardness; even good plaster of paris, if given twenty-four hours to harden, will nearly prevent contraction; plates do not warp in polishing; plates may be reduced in size by immersion in hot water, contraction beginning at 130° F. Vulcanite may be stretched when heated till pliable.

To theorize: Thick plates are probably more subject to contraction than thin ones, because of being better able to overcome the resistance to contraction offered by the investment. Besides, very thick plates have a vertical contraction which is not altogether to be ignored, seeing that it is quite uncontrolled, and that the contraction of a mass of vulcanite one-half inch thick is about 0.17 millimeter at first vulcanization.

The force with which a very thick lower plate contracts probably sets at naught the resistance of any investment. For such the serrated bar would be very beneficial. As the power of an investment to control the contraction of a plate must depend upon the hold it has on said plate, it seems probable that the little pits caused by bubbles, etc., in the investment, and which fill with rubber in closing the flask, are to be regarded with friendly eyes.

In conclusion: The contraction of vulcanite in cooling, though theoretically an evil, has undoubtedly been a friend in disguise to the plate-maker, counteracting in a crude way the expansions of plaster and the uneven compression of models in flask-closing. As plaster of paris expands while crystalizing, then expands still more during the following twenty-four hours, then suffers compression during flask-closing in such a way as to throw the plate's greatest pressure on the palate, and then expands again enormously under the steam of the vulcanizer, this contraction of vulcanite in cooling has come as a blessing, and in the few cases where it has exactly balanced the other evils a successful adhesion has been obtained, this success having resulted perhaps from the mere chance that the case was vulcanized when the investment had enjoyed a night's rest in which to harden, or *vice versa.—Items.*

UNIVERSITY TRAINING AND DENTAL EDUCATION.

By Harry P. Carlton, DD.S., San Francisco. Read before the Fifteenth Anniversary Celebration of the Odontographic Society of Chicago, February, 1903. I shall make no apology for asking your attention to a further consideration of a subject already much and often discussed in our faculty rooms, in our society meetings and among the profession at large. I wish in my paper to present this aspect of the general theme—the education of our dental student should be more thorough and extensive than it has been or is, and particularly the preliminary training, heretofore sadly deficient, should begin earlier and be more substantial. My enthusiasm in this branch of the service is born of an honest desire to see our profession placed on the high plane it justly deserves, and it lies with us. To this end will I ever give of my best endeavor as I have opportunity, according to the measure of my ability, and I feel that I have the hearty cooperation of the thinking, progressive, intelligent body of student practitioners that constitute the profession of to-day. I realize how difficult and dangerous it is to dogmatically proclaim what I would do "if I were King," but we all like to play at being King, if but for a day, and this is what I think I should like to do—what I trust the future will bring forth, and that ere long. It is a desire resulting from a constant association and personal contact with dental students for the past fifteen years—again from a mingling with large bodies of professional men, of our own calling and others, in many cities and states, from an observance of the effects of environment upon both brain and body (even in the three short-term courses in dental college) in more than fifty per cent of the crude material presented to us as students. From all this comes my purpose in presenting this paper.

I have grouped my material about two main points: First, the *Demands of the Day,* and second, the *Way to meet these Demands.* There is nothing upon which men and nations of the present day so pride themselves as their progress. We who have entered upon the threshold of the twentieth century are already seeing such wonderful changes, even since its early dawn, that we can almost conceive that before its close there will be little left to be desired among men when the twenty-first shall have arrived. As a profession, will we be prepared to take our place in the procession? In the matter of gaining knowledge we have not even been (as Newton has said)

"like children picking up pebbles on the beach, while the great ocean of knowledge stretches out beyond us." We are coming to the point where we must know the science of things, rather than that which is merely on the surface. Right in line with this spirit of progress must march the most modern of the professions—our profession of dentistry. Progress says to us, "Cast in your lot with me and prosper, resist me and be crushed." Many of you here to-day have seen the gigantic strides she has already made. Even in my limited career I have witnessed the rapid advance along lines of dental education. The dental college curriculum of yesterday is not that of to-day, nor will that of to-day be the standard of to-morrow. Much of the study and experiment resulting in these recent discoveries was done in the laboratories of the colleges and universities, for nowhere was progress during the nineteenth century more apparent than in education. At the beginning of the century the traditional classical curriculum was practically the only one recognized, but more and more as the century advanced the claims of scientific men were recognized, till now no university is considered complete without thoroughly equipped scientific colleges, and thoroughly endowed schools of technology are found throughout the country. In consequence the world is to-day making great demands upon each member of society.

The demands of the day are indicated still further by the multiplication of technical schools and colleges all over our country, giving careful and systematic training in what have been regarded as the humbler trades, cultivating and ennobling them to the status of professions and conferring upon them a scientific degree. To-day the machinist, the miner, the farmer, and the dairyman spend three or four years in a school of technology or in one of the colleges of a university, the requirements for entrance to which presupposes a full high school course of study, embracing the ancient and modern languages, advanced mathematics, theoretical and applied, physics in its various branches, chemistry and other sciences. To-day the boy enters a school where he is taught to forge iron, to use the file and the saw and the plane. If he intends to till the ground he learns the chemistry of soils, the nature of fertilizers, the qualities and values of fruits, vegetables and grains. He is taught the physiology of the domestic animals, and to make butter and cheese scientifically. More than all this, he is trained to study, to think, to experiment, to originate. If we, the profession of dentistry, expect our grad-

uates to be on a par with these young men, to occupy honored stations in cultivated communities, to command the respect of intelligent people, we must parallel their standards.

The demands were less in former years, when the village barber was the surgeon, when the country doctor or the village blacksmith twisted out the aching molar with his old turn-key. Their civilization was that of the border, for they were engaged in overcoming the savages of a continent. In those days the so-called self-made man, the man of all around attainments, was the valuable man, the valuable citizen. He could build a good chimney, prescribe a dose of blue mass or castor oil—in an emergency serve as an accoucheur, and on Sunday preach a fairly good sermon. To-day demand is measured by the station of the individual—of the man who calls himself "Doctor" more is required than of him who is styled carpenter, blacksmith or watchmaker. Mere mechanical dexterity is not enough to warrant a claim to any higher rank than that of skillful workman. The world, it is true, concedes titles to fakirs and mountebanks of all kinds—dime museums have their "Professors" who swallow swords, long-haired "Doctors" who shoot at glass balls, "Colonels" who break bronchos. But the world displays no such complaisance towards the man who makes a pretense of superior knowledge in the realms of science and art.

We live in an age of science, when appreciation and honor and wealth await the greatly deserving, but where men's credentials are scrutinized, and their claims held in abeyance by the intelligent. In all professions the cry is for progress, for more light and larger-minded men; the age bristles with interrogation points, and new sciences are constantly bringing fresh surprises to our knowledge, necessitating a constant revision and readjustment of our views. Browning says:

> "Man, therefore, thus conditioned, must expect
> He could not, what he now knows, know at first,
> What he considers he knows to-day,
> Come but to-morrow, he will find misknown.

We are not asking too much of the coming generation; a comparison with the recent past justifies high expectations for the future, and we should be encouraged by the progress already attained as encouragement to further progress, but in spite of the tremendous strides of the past we are now face to face with this problem—do we

want to be adjudged a merely high-class mechanical vocation, or a broad-minded, intellectual, scientific profession?

Dr. Kirk dates the birth of dentistry from the founding of the first college, the first society and the first journal, in 1839 and 1840, and says: "Like all other professions, dentistry began as an art, characterized by a superior handicraft in the doing of operations, mostly of a restorative nature in repairing the ravages of disease upon the human teeth." An humble birth and beginning, and not much thought of in those days. But we quickly shook aside the swaddling clothes and made phenomenal and vigorous growth; all honor to those pioneers of dental art and early dental education. To continue again in Dr. Kirk's language, "The development of the art has been so thorough, that though we may not safely say that future progress is impossible, yet the multitude of methods and devices at our command would seem sufficient in number and adequate in kind to meet all exigencies of practice for years to come." We may add a wheel or two here and there, simply improve in slight degree the mechanism, but it certainly seems as if the machinery and the tools are nearly perfect. He also refers to the demand now being vigorously made from many quarters that dentistry be classed as an "independent" profession and given equal status in the specialties of the healing arts.

I quite agree with him that much, aye very much, remains to be done before that recognition, as such, can be accorded. If we would have the respect and regard of the other professions we must first respect ourselves. Dentistry should be a full profession and recognized as such, but it will be only when the character of the men who comprise it bring its recognition up to what it should be. The conferring of the dignified degree of Doctor upon men of deficient culture is wrong, and for this reason we fail of recognition not only abroad but at home. "Doctor" is but an empty title as now used, while it should stand for learning and culture. I have heard with much distress our degree of Doctor of Dental Surgery referred to as "a gaudy jacket, which in many instances is but a cloak for ignorance, a bauble to be laughed at by the world of learning, and a source of mortification to many a wearer."

I have said that any increase in dignity and professional status must come from within the great body of the profession itself. To gain these ideals and make the profession what it should be a high

grade of young men must be attracted to its ranks. As soon as the best men are attracted excellent work will really be done and the development will then be a natural one. The community, as well as the student and the profession, will begin to understand the great meaning and worth of productive scholarship, and its great superiority to mere receptive and distributing scholarship.

In considering this my second point, the way to meet these demands, there should be no necessity for pleading the value of a higher education, the value of more thorough preparation for the duties of life. The man who doubts this is beyond the reach of argument. An uneducated man looks out on life through narrow windows and thinks the world is small. The educated man learns to face great problems seriously and to work patiently for their solution. The men who made our country were its educated men—not its college graduates alone—but men of high ideals and broad mental training, to give which is the end of higher education.

Certain persons of power and position in the financial and industrial world have questioned the value of a higher education. They say too much time and effort is expended to no avail in acquiring a university education, which could be put to better advantage by devotion to courses of study devised to equip one for the practical pursuits of life. Conceding, however, that the higher or university education can be dispensed with by one who intends to become an artisan or man of practical affairs, I hold that when we come to consider the relations of the professions to the demands of the modern world the university education is imperative and should precede entrance to professional life. Defining education from the point of view of preparation, it is simply a process of developing the human mind along lines of correct thinking—it is a means to an end. It is not what you put into a man, but what you can get out of him that is a test of his education. Education comes through applied, systematic methods of mental training, and when properly fostered results in a mind that can create. The statement is sometimes made that "Education is something larger than any particular method employed to acquire it, that institutional methods are not essential, and that the question of education after all is purely personal and lies with the individual, with whom it is optional whether he shall seek it in the university or elsewhere." Assuming that the individual can and will secure an education

equivalent to that which the university affords, that is true, but experience teaches us that unless acquired in the universities or colleges it is not apt to be acquired at all. There are of course illustrious examples of self-educated men in almost all the various fields of human endeavor—Benjamin Franklin, Horace Greeley, and Abraham Lincoln, for instance, and others; but the Lord didn't make Franklins or Greeleys or Lincolns when he made the most of us. They are the exceptions, and I will make the assertion that without a university training the average man is not a well educated man. But why teach our boys Latin and Greek, Euclid and Calculus? Engineers cannot be developed on figures alone—nor scientific dental surgeons on cavity preparation. An old farmer was once asked by his neighbor why he sent his son to college if he expected him to come back to the farm. "Wal," he said, leaning on his plow, and casting his eye along the last furrow, "jest so he could plow a leetle closer to that stump yonder."

The professional man should possess the resources of a highly developed reasoning faculty, which comes only after years of systematic pursuit of what may be called higher or university studies. This broad mental training will make better dentists and better men, for it means that knowledge of things which enables a man to meet men; it means an assurance of life, a breadth of horizon, a seeing above the chimney tops, beyond the drudgery of detail to the big things; it gives that confidence which makes a man feel equal to any emergency; it gives humility at the thought of the many things he does not know; it makes him marvel at the wonders of nature, and gives him a determination to do the best he can in the position where the Almighty has placed him, never helpless, always self-reliant; it makes of him a broad-minded man, who need not seek other company to give himself thoughts, who is always good company for himself, and therefore is better company for others. The difference between the educated and uneducated man is marked in a great degree by the confines of their vocabularies. Every added word conveys an added concept to the mind and every concept broadens and enlarges the mind to which it is an attribute.

Look at this from another point of view—the financial success, if you please. Wherever you go or whatever you do, you will find the trained man has the untrained man at a disadvantage. There is no better way on earth of thinning out the incompetent men in

the professions than to bring trained men into competition with them. The man with the broadest training will not only be the better workman, he will also gain the best class of patronage. Acquaintance will tell here, for no matter how large the town or city there are circles within circles; people of culture and cultured taste find each other out. The professional man who knows things outside of "shop," who can mayhap scan a line of Virgil, or explain the binominal theorem, will find, other things being equal, more friends, more patronage, than he whose literature is confined to the daily newspaper.

George William Curtis is quoted as follows: "I have heard it said that a liberal education does not promote financial success in life. A chimney sweep might say so; without education he could gain the chimney top—poor little blackamoor—brandish his brush and sing his song of escape from soot to sunshine. But the ideal of success measures the worth of his remark, that it may be attained without liberal education. If the accumulation of money be the standard, we must admit that a man might make money in a hundred different ways without education."

I maintain also that a man of cultured mind, who has thus drawn about him a class of patronage of self-respecting men and women, will be so self-respecting and so intelligent that he dare not slight his work—that he must maintain a high standard of skill in his profession, that he must be well read, that he must attend professional gatherings, and know that the world moves, and that science is advancing. He will not dare to go backward, but must ever offer to his exacting patrons the best the world has known in special lines of scientific progress.

Nowheer on earth is the raw material out of which scientists, scholars, statesmen, aye dentists should be made, so plentiful as right here in our own country. American dentists are generally conceded to be the most skillful in the world; this more through individual capacity and native ingenuity than from any requirement of our dental schools—but skill plus wisdom will always be valued and paid for. On every hand we see new methods that demand not only more knowledge and skill from the practitioner, but more insight and sagacity, a higher degree of disciplined intelligence. What makes a surgeon great? Is it his manual dexterity, his manipulative ability? We have all seen a butcher with apparent careless-

ness whip his knife through the beef and sever it at the joint with utmost accuracy. Look at the hands and wrists of the pugilist Jeffries, then at those of Lorenz the surgeon; they are practically of equal strength—Jeffries uses his to punch men's bodies out of shape, no matter how; Lorenz uses his to punch them into shape, knowing exactly how.

Higher education is not a question alone of preparing great men for great things—it must also prepare little men for greater things than they would have otherwise found possible. As a good beefsteak disappears in a man and reappears as energy and vigor, so is education absorbed and reappears as mature judgment, mental balance, keen, acute, grasping intellect. Is there a practitioner among us not holding the degree of Bachelor of Science, Bachelor of Arts, or Doctor of Medicine, or otherwise, who does not bitterly regret opportunity slighted or unavailable? He would indeed be glad to possess them, not for the mere degree's sake alone, but for the education's sake. Doctor Butler, Columbia's new President, in his annual address, favors granting the Bachelor's degree at the end of two years of university study, leaving the Master's degree to be gained in two more. The Bachelor's degree, he says, would admit to the professional courses (note where he ranks our admission requirements) and be so arranged as to constitute a suitable foundation for them, or for courses in general science or letters.

Johns Hopkins has set a great example, not only to medicine but to us, by demanding a degree for admission to its Medical School, and Harvard since 1901 has required a degree in Arts, Philosophy, Science or Medicine. This standard is none too high for best results in any professional work; he who has waited a year or two more to secure this degree will not be handicapped even in this hurrying age. How few professional schools have entrance requirements that amount to much; they may have requirements that look well in the catalogue or annual announcement, but most of them accept without question or investigation certificates from teachers or obscure preparatory schools and the like. There are approximately sixty dental schools in America—to quote from a recent compilation—"3 have no express admission requirements; 18 have purely grammar school subjects for entrance; 18 more, first year standing in high school work; 11 have requirements covered by about two years of high school work, and 6 require a

three years' high school course; none of them as much as is required for admission to any reputable college. Most medical schools are the same, simply requiring grammar school subjects—some demanding high school work;" but I am happy to say the Medical Department of the University of California demands full admission to the University proper before a student can elect to take the course, and our next dental catalogue will, I hope, make the same announcement for the Dental Department.

Too often dental schools appear on the register as a department of some university, in most cases a relation existing only in name. When a dental school is endowed or has its state behind it it can and should exact the standards the good of the profession requires. Until then it is at the mercy of the demands about it and its students are the product of its surroundings rather than the choice of the school.

I trust I have said enough to prove to you that the opportunities of modern dentistry are so new and vast that an ampler education is needed by the practitioner of the future. We cannot give him that education in a four years' course at a dental college. Let him take ten, if necessary, with the preliminary—it will be worth the while, and his place in the professional world will wait for him. The four-year courses in our dental institutions will be well and completely filled with good instruction and practical work, and the teaching staff will no doubt be improved and methods strengthened and advanced. No more can be done by the dental student in those four years—all he wants and needs he cannot get in that period. Where, then, can we turn for the improvement and addition if not to the period of preparatory school life? Note the difference in the ages of the applicants to our dental colleges nowadays—they used to be men grown, "gray-headed undergraduates," as some one has said; now they are all boys, and the more reason why they should be better prepared. To fit a man into our schemes of dental education has been the mistake of the past; to fit our education to the well qualified man is the work of the future. If general culture is to be an element of professional success our colleges should say so to those who would seek to enter their doors and say so at once.

At the risk of being tiresome I wish to briefly present to you what seems to me an ideal preparatory course, prerequisite to professional study: A complete scientific course in a good high school,

with English for general culture; algebra and geometry for mental discipline, and also because they are of help in the chemistry and physics later on; at least two years of Latin, first for mental decipline and second because of its practical use in nomenclature and in anatomy; coupled with this a course of manual training. In the last year of the high school I would have the student take physics and chemistry in the laboratory, and biology in laboratory and field —not text-book knowledge only in these subjects, but the actual confronting of student with nature. In this way he tests his knowledge for himself—he early acquires scientific methods in accepting no conclusion that is not demonstrated; he is not entirely dependent on a teacher.

Now send our boy to the University—he takes a continuation of the chemistry, physics and biology (because they are necessary for the later study of physiology, pathology, bacteriology and microscopic anatomy) histology from the highest plane; and in addition a reading knowledge of French or German or both (good because accounts of so much original work are published in these languages). During the two years required for this work there should be added for the general culture of the well-rounded student a general academic course in English Literature and American History.

Then he goes into the professional school proper. In the first and second year he takes anatomy (gross and microscopic), physiology, pathology and bacteriology, under the guidance of men with the same scientific point of view and scientific methods as he had in the academic two years; in other words, men who are non-practitioners and men of productive scholarship, who devote themselves to the leadership of the student, besides giving a goodly amount of their time to original work and research. Nobody would select as professors of chemistry or mathematics in any university, respectively, a man in the employ of a gas company as chemist, or insurance company as expert statistician—yet that is similar to what most of our colleges have been expecting of their pathologist, bacteriologist or anatomist. In the leading medical schools of the world these studies are in the hands of men who devote their lives to this special work instead of giving instruction in the intervals of a busy practice. During these two first years the student takes his complete technic courses, operative, prosthetic and others, in completest de-

tail; metallurgy, which is fundamental, and dental chemistry. Next I would have him take more or less internal medicine, pharmacology, and physical diagnosis. At the completion of these four university years he has earned and received his degree of Bachelor of Science. During the succeeding two years I would make didactic work merely incidental, devoting the bulk of the time at chairside and bedside. This would of course include the clinical work in dental pathology and therapeutics, practical orthodontia, oral surgery and other practical dental subjects.

I have mapped out a course that may be merely ideal; one, you may say, that disregards present conditions, one for which dentistry is not ready, and that will not be feasible in the immediate future. My position may be too advanced, but what would be the result of realizing this ideal? We would bring in better men, superior men; we would turn out real Doctors of Dental Surgery with a scientific degree as well; the doors of our profession would be shut against the trifler and the tinker, and we would reserve the training of our schools for those who bring to the work the instincts, traditions, and outlook of the scholar. In presenting this paper to you I have borne in mind two essentials—the necessity for a high ideal, and the importance of urging it by sound arguments. I am sure of the one, and you are to be the judge of the other.—*Review.*

A BRIDGE TOOTH. By D. D. Lester, Christiansburg, Va. I have found a tooth constructed after the plan of the "J. Y. Crawford Crown" convenient in place of the ordinary bicuspid and molar dummy in bridge work. To make such a tooth, select a rubber plate tooth of suitable size, shape and color, allowing for the thickness of gold; then from twenty-eight gauge gold make a jacket or cup in which the tooth will fit snugly, Fig. 1, allowing the gold to come about to the grinding or occlusal surface, except at the buccal or especially mesio-buccal aspect, where it should be cut away for esthetic reasons.

The cup or jacket is quickly and easily made by taking a strip of plate (twenty-eight gauge) and bending around the tooth to get the correct length, making it rather large in diameter, to permit of proper contouring; then push the tooth in place in the tube thus formed and mark the length and slope of the tooth on the inside of the tube as a guide in cutting the cervical end of the jacket. When

it is cut to the proper length and slope it will perhaps need some shaping with the contouring pliers; probably the cervical end on the buccal side may need drawing in to make it fit the contour of the tooth, and perhaps contraction may be indicated at the occluso-lingual edge also. When shaped satisfactorily place on a piece of plate for a bottom and solder. Put the tooth in the jacket, Fig. 2, and arrange on the articulator, and when in a satisfactory position run a little investing material around the cervical end to hold it there. After removing the tooth, solder the jackets and crowns to the bridge, polish and cement the tooth in place. You have a bridge

Fig. 1.

Fig. 2.

in which the porcelain has not gone through the fire, and if broken in any way it can be quickly and easily replaced without removing the bridge from its abutments, by simply selecting another tooth and cementing it in place. The tooth is much neater in appearance than the old-style dummy and requires less time to make. Undercuts can be ground in the tooth with wheel or disk, and the inside of the jacket should be roughened with a cross-cut fissure bur to secure adhesion of the cement.

The same jacketed tooth soldered on a cap fitted to the root of a natural bicuspid is the "Crawford Crown," and it is a good strong one, as the jacket affords strength as well as a means of replacement in case of accident.—*Items.*

SPLINTING LOOSENED TEETH IN PYORRHEA ALVEOLARIS. By M. L. Rhein, M.D., D.D.S., New York City. Read before the New York Odontological Society, January 20, 1903. The splinting of loosened teeth, either for a short period or as a permanent operation, has become during the past ten years a recognized operation in the treatment of pyorrhea alveolaris. Fifteen years ago at the annual meeting of the First District Dental Society I had the honor of presenting a patient having eight lower teeth firmly united by means of a platino-iridium wire, held in position on their occlusal surfaces by gold fillings. The case is reported in the *Cosmos* for March, 1888.

The report of this case has unquestionably been the inspiration for considerable development in the saving of loosened teeth. In this case the pulps were left undisturbed. Nevertheless, the teeth, whose immediate loss had previously appeared to be a certainty, were preserved intact for nearly seven years and some of them for over ten years. Our present knowledge of the local pathology of such conditions brings with it the firm conclusion that had the pulps of these teeth been removed, the operation would have remained a success to the present day. Unfortunately, however, at that time we had not cast aside the slavish shackles which bound us fast to the creed which upheld the sacredness of the life of the pulps in adult teeth.

The advantage of holding these very loose teeth firmly together consists in allowing new embryonal tissue to become adherent and attached, which otherwise would be lost almost as soon as it was formed on account of the wild movements of such loosened teeth. With some little knowledge of the historical data of this subject, I believe that our present inspiration for holding loose teeth immovable by means of various forms of splints is due primarily to that great teacher of American dentistry, the late lamented and endeared Dr. Wm. H. Atkinson.

Many methods have been employed for splinting by different men during the past ten years. The desire to perform the operation as speedily as possible has brought into use many crude splints, such as cementing a series of soldered bands or rings around the teeth. This is perhaps the most unhygienic form of splinting that has been devised, and cannot be too strongly condemned on account of its filth-carrying properties. All the splints that as a final operation are cemented into place have more or less objectionable features. These consist primarily in an exposure of their cement surfaces, and in the fact that it is almost impossible to have the splint on an even surface with the enamel surfaces of the teeth.

Whenever it is deemed advisable to unite teeth firmly and permanently together, either for the sole purpose of supporting loosened teeth or in addition the carrying of a denture for the replacement of some lost tooth, the most skillful kind of work is demanded. If the work is to be of a really permanent character the pulps of all diseased teeth should at once be removed.

In the posterior teeth where they are concealed from view, the

appearance of gold is not forbidden. Especially if the molars are broken down, and some tooth missing, it becomes an easy matter to remove the pulps, grind down the teeth, and place in position the ordinary gold bridge cemented upon two abutments. With the anterior teeth we are confronted by a more serious problem. In these cases it is primarily essential to preserve the natural appearance of the teeth and see that they are not marred by any unsightly

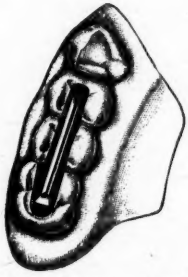
FIG. 1.

FIG. 2.

appliance, and secondly it is necessary to obtain sufficient strength to make if possible a permanent operation. To accomplish this the greatest ingenuity and skill are demanded.

A general plan of splinting such anterior teeth can be derived from the models hastily prepared by my assistant. This one (Fig. 1) illustrates the replacement of a missing upper lateral incisor, where the central incisor has become loosened through peridental disease. The next specimen (Fig. 2) shows the manner of fitting

FIG. 3.

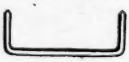


a permanent splint to loosened lower teeth. The pulps have been removed, and a staple of triangular-shaped platino-iridium wire with three parallel pins fitted into the three individual root-canals is seen lying in position. The next model (Fig. 3) shows the same method applied to two upper bicuspids and a molar, in which the pulp in the molar is not removed.

Returning to the first model I will endeavor to make clear the detailed steps of such an operation. The illustration used to depict the technique is supposed to show the palatal surfaces of the upper left central incisor (loosened from disease) and the cuspid with the lateral missing. The pulps of both of these teeth have been removed, and the ends of the roots sealed with chloro-percha covered by a thin film of zinc oxyphosphate. A broad groove or slot is now cut into the palatal surfaces of these teeth from the entrances of the pulp-canals to the approximal surfaces, as shown in Fig. 4. At the

FIG. 4.

FIG. 5.



same time a piece of triangular-shaped platino-iridium wire is bent into the shape of a staple, as shown in Fig. 5, with the parallel ends fitted into the root-canals of the two respective teeth.

After this has been accurately fitted, so that the base of the triangular wire rests snugly in the bottom of the groove, a backing is attached to the horizontal bar in which to carry the artificial tooth. (See Fig. 6.) This backing is of the character generally advertised as the Mason, in order that the porcelain facing can be cemented into place after every other operative measure has been completed.

FIG. 6.

FIG. 7.

The next step in the operation consists in lining the groove and the circumference of the outer plane of the pulp-canal's orifice with a thin gold filling, as shown in Fig. 7. This must leave the entrance to the canals open for the admission of the ends of the staple. This is easily accomplished by filling the canal with a cone of bibulous paper not quite to the entrance. Over this is run a thin film of cement, and while this is still soft gold is gently patted into the cement, and a few minutes later gold foil is malleted over the entire inner surface of the slot and around the orifice of the pulp-canal. With a fissure-shaped bur the entrance to the paper cone in the canal

is easily made and the paper withdrawn, leaving the canal open for the admission of the pin, as shown in Fig. 7, copied from the natural tooth which has been prepared in this manner. The next step is to fill both canals with zinc oxyphosphate, of just sufficient amount to avoid any excess, and the splint is then cemented into its proper position. (See Fig. 8.)

After the cement has sufficiently hardened, the gold filling which lines the groove in which the staple lies is continued and brought

FIG. 8.

FIG. 9.

FIG. 10.

up over the sides of the wire, which is ultimately completely covered by the gold filling, as shown in Fig. 9. When this is properly finished with plug-finishing burs and fine cuttlefish disks there is no edge or unevenness present. This is perhaps more readily seen in this specimen of a natural upper cuspid. It shows the completion of such a filling and the triangular-shaped wire protruding from the approximal side of the tooth. (See Fig. 10.) The remaining portion of the staple has been cut off. No other method will give so smooth and finished a surface. The porcelain facing which has been previously ground to fit is now cemented in the backing and the operation is completed.

All sorts of variations of this method can be employed, depending upon the character of the case. The great advantage claimed for this especial technique consists in the perfectly smooth and polished surface, attainable only by means of a gold filling.

Where only a splint of a temporary character is desired ligatures are much preferred. The great objection to them has always been that they were filth-carriers. This celluloid cement that was introduced to us from Russia at the last International Dental Congress can be used in these cases to great advantage, by covering the ligatures with the cement. For this purpose a fine wire, of about No. 30 gauge, made of pure silver, has given satisfaction. In certain cases where there has been considerable loss of gum tissue and it is advisable to tie the ligature close to the necks of the teeth, it has been found that sometimes the ligatures will move upward toward

the gums even though the ligatures are covered with celluloid. It has been discovered that this objection can be overcome by cementing small buttons of oxyphosphate of zinc cement upon the necks of the teeth immediately above the point of placement of the ligatures.

This model (Fig. 11) holds four natural lower teeth with the

FIG. 11.

roots supposed to be partly exposed. It shows this manner of wiring covered by the celluloid cement applied so that the model can show the wire covered and uncovered. It also exhibits the little buttons of zinc oxyphosphate cemented upon the necks of the teeth to prevent any displacement of the silver ligatures.—*Cosmos.*

PHYSIOLOGICAL ARTICULATION OF THE TEETH. By Dr. J. H. Morrison, Connersville, Ind. Read before the Indiana State Dental Association, 1902. By physiological articulation I mean the various relations the lower teeth assume toward the upper during the complex movements of the mandible in mastication, in contradistinction to occlusion, which refers to the position of rest when the teeth are closed. I had thought that a historical sketch of the development of the subject would emphasize its value more than anything else, and had hoped to present it in that way, but I find that the resources at my command and the limited time will allow me to speak only in general terms.

To secure the desired articulation of artificial teeth, the older practitioners resorted to a method that is still familiar to many of you and still used to some extent in mounting specimen cases. The plaster of which the model was made was extended beyond the palatal border of the impression from one and one-half to two inches. This extended portion was neatly squared up and a transverse groove cut in its surface near the posterior border. On this a model of the occluding teeth was cast also with an extended

portion which would have a ridge fitting into the groove of the first piece. These two pieces of plaster formed both model and articulator. It gave only the occlusion or apposition of the teeth when at rest. It permitted not the slightest change in the relation of the models, and if the operator wished to open or close the bite, he was compelled to go back to the patient and make the correction on the wax models in the mouth.

In the description of this early method it was advised that the distance of the transverse groove from the incisor teeth be the same as that from the incisor teeth in the patient's mouth to his external auditory meatus. This is the first reference I find to the relation of the articulation to the hinge which controls it, showing that these early workers recognized something that was largely overlooked when metal articulators came into general use. The metal articulator was introduced to save the labor of making the old plaster one, and to allow slight changes to be made in the relation of the models to each other, with the idea that a suspected error of the bite might be corrected in the articulator. But as late as 1875 I find the author of a popular text-book expressing a preference for the old plaster articulator, because the metal ones encouraged carelessness, and because changing the relation of the models was a very doubtful procedure. The author's objection will be appreciated if we remember that the opening or closing of the articulator in the smallest degree will destroy the accuracy of the occlusion unless the models are mounted on the articulator at precisely the same distance from the hinge as they are from the condyle in the mouth. Metal articulators, however, came into general use, and from 1860 to 1895 many forms were offered, some providing means for adjusting the relation of the models, and at least as early as 1875 some of them imitating the lateral movement of the jaw. With the exception of that of Dr. Bonwill, I am not aware that any of them had the hinge or pivotal joint constructed with reference to the intercondyle measurement of the jaw. Dr. Bonwill informs us that his anatomical articulator, designed to reproduce the exact movements of the mandible, was invented in 1858. Not until much later, however, did he read a paper before the Delaware Dental Society, describing his system of articulation. This was followed by another article in 1885, and still another before the World's Columbian Dental Con-

gress in 1893, and the world is now familiar with Dr. Bonwill's system of articulation of the teeth and his theory of the equilateral triangle.

It is not my purpose to review all his theories, but merely to summarize. Observing that the distance from the condyle to the tips of the incisors was approximately the same as from condyle to condyle, he established the fact that in the movements of the jaw the teeth must move as would points situated on or near the side of a triangle pivoted upon two of its angles. When the jaw is protruded, bringing the incisive edges of the anterior teeth together, the distal cusps of the lower second molars should be in contact with the upper teeth, all other teeth being free. When the jaw is thrown to one side the condyle upon the side toward which the jaw moves remains in its seat or slightly rotates, and the opposite condyle moves forward. This should bring the buccal cusps of the upper molars and bicuspids on the side toward which the jaw moves upon the lingual cusps of the lower teeth, and on the opposite side the buccal cusps of the lower teeth should rest upon the buccal cusps of the upper, and the lingual cusps upon lingual cusps. The overbite is determined by the depth of the cusp of the first bicuspid, and incisive action is provided for by the curvature of occlusal line in the region of the molar.

These were regarded as the ideal movements of the teeth in mastication, and those which Dr. Bonwill's articulator and elaborate system sought to secure in the articulation of artificial teeth. Whatever honors the profession accords the memory of Dr. Bonwill, it cannot deny him the distinction of having been the first to announce the principles involved in the equilateral triangle. They are the fundamental principles controlling the movement of the teeth, and must be the basal principles in the articulation of artificial teeth so long as the human jaw is constructed as it is. In an article published in a September journal of 1899 Dr. Bonwill said: "I here revise all I have said on this most important of my life's work, and upon which I am willing to die, feeling assured that this work can never be blotted from the world's record." These words were prophetic, for the October number of the same journal recorded the death of Dr. Bonwill, and to-day the main principles for which he so long contended are acknowledged throughout the world.

These theories were received with enthusiasm by many, but,

judging from what I can learn from the journals, they were received by the profession generally with some indifference. Many stated that after the most careful work in mounting the teeth in the articulator, when the teeth were placed in the mouth they would not behave as on the articulator. Something seemed wrong. Recently it has been thought that the difficulty lay in the fact that the method provided for accuracy only at the incisors in locating the model on the articulator, leaving the position of the posterior portion of the model to guesswork. To meet this difficulty the Snow face-bow was invented, by the aid of which a model may be placed upon the articulator in approximately the same relation to the pivots as the teeth in the mouth bear to the condyle, but there was still another step in advance to be taken.

A few years ago, and independently of the studies of the subject by the dental profession, there appeared in one of the dental journals an abstract of a paper read before a society of histology. The paper gave the results of extended observation of the teeth of animals, made for the purpose of ascertaining what the arrangement of the teeth had to do with the evolution of species. It was shown that in most carnivorous animals the teeth had long, sharp cusps, the jaws of equal breadth, and the rows of lower teeth in line with and immediately under those of the upper, the jaw using the vertical movement only during mastication. In many omnivorous animals the upper jaw was wider than the lower, the upper molars and bicuspids overreaching the lower on either side. The cusps were still prominent, and were found to be arranged upon circles entering at the condyle or at some point between the condyles. The concentric circular arrangement of the cusps is the point of special interest.

In 1895 Dr. W. E. Walker read a paper before the Southern Dental Association, giving an account of his extended studies of the glenoid fossa and the movements of the mandible. This was followed by other papers on the same subject in 1896, 1897, and 1899. Dr. Walker's investigations seemed to show, first, that in protrusion, or during the lateral movements of the jaw, the condyle travels downward as well as forward, and that the downward travel is caused by the slant of the roof of the glenoid fossa; second, the line traveled by the condyle, intersecting the facial line, forms an angle that bears a vital relation to the angle formed by the line of oc-

clusion of the teeth, or of the alveolar border with the facial line, and this condyle alveolar angle must be reproduced in the articulator before perfect articulation in the teeth can be secured. It is stated that the condyle alveolar angle ranges from twenty-five to forty-five degrees, and is frequently greater upon one side of a jaw than upon the other.

It had previously been thought that during the lateral movements of the mandible one condyle remains stationary while the other moves forward. It is here shown that frequently one condyle moves slightly backward while its fellow moves forward. This has the effect of shifting the fulcrum or pivot from the condyle to a point between the condyles, and so shifting the circles upon which the cusps of the teeth move. This explains the concentric curves mentioned in the paper on histology to which I have referred, and discloses another factor in the condyle movement to be taken into account in efforts at perfect articulation.

Dr. Walker produced a facial clinometer for measuring the various angles to which his work refers, and an articulator adjustable to these angles, and designed to reproduce the exact movements of the jaw. These I shall not attempt to describe, but close with a word as to the value of the theories outlined. The condyle is hung in the glenoid fossa by flexible ligaments, and allowed more or less movement in all directions, and it may be suggested that the angles and movements referred to are too minute to be applied under such circumstances. It will be remembered, however, that the form of the skull or bones does not vary so much as does that of the muscles, so the movement of the jaw, being controlled by the form of the condyle and of the glenoid fossa, will be more definite than might be supposed.

The fact that twenty-five years were allowed to elapse after these principles were announced before their value was generally recognized, and this at the very time prosthetic dentistry was retrograding, would seem to indicate that an opportunity had been lost.

A glance through the dental journals will show that as early as 1875 a complaint came frequently to be made that prosthetic dentistry was degraded, and this was so often repeated that many came to think that as professional men mechanical dentistry was beneath them. The older practitioners thought that this degradation was because of the introduction of cheap materials,

notably rubber instead of gold and silver, this bringing cheap, careless methods, but the artist is known not by the material with which he works, but by the truth, harmony, and beauty displayed in the results he secures and the knowledge manifested of the fundamental principles of his art. If prosthetic dentistry has fallen out of its proper relation to operative dentistry it is because the profession has failed to give it that careful and painstaking investigation which has characterized the progress of conservative practice.

It is a matter of common faith that the food of man should be reduced to a pulp before it passes into the stomach. Dr. I. N. Broomell, in a recent and very interesting article, takes the position that each temperament is provided with a dental arch characteristic in form and in the length of the teeth cusps, and so indicates the class of food upon which that temperament should be fed. Deprived of that food, or of suitable dental organs to properly masticate such food, the person suffers in health.

Dr. Black has shown that teeth with prominent cusps have a much greater crushing power than those with smoother surfaces, and I have referred to histology, or rather comparative anatomy, as showing that the most effective arrangement of cusps is of circles concentric with the condyles, or some point between the condyles. Dr. Walker's investigations seem to show that even after the loss of the teeth we have in the movements of the condyle an index of temperament and the form of teeth that should be supplied. The complete attrition of food is accomplished by the short lateral movements of the cusps of the teeth by and over each other, but these movements cannot be perfectly accomplished if well-defined cusps are placed without system or at haphazard. But by arranging them upon a system of circles concentric with pivotal centers, and in known relation to each other, we may secure the highest efficiency as regards the mastication of food, and a form of occluding surface that will greatly increase the stability of the plate.

A practical side of the question, I think, may be found in the education of patients. Few of those who come to us for artificial teeth recognize any requirement beyond the sticking qualities of the plate. Some instruction given to the patients as to the mechanical principles involved, pointing out the various positions where the plate is balanced, such as the touching of the molars when in an incisive position, will greatly enhance their appreciation of the

work, and, more than anything else I know of, distinguish the cheap shop work from that of him who applies the real principles of his art.

I think no one has been so quick to recognize the value of physiological articulation as have specialists in orthodontia. Successful work in that department demands a careful study of all the forces which influence the dental organs. The action of the cusps upon each other cannot be well studied in the mouth, so it becomes a matter of inestimable value to be able to place models of the teeth in an articulator that will precisely reproduce the movements of the jaw. We can then study effectively the action of the forces against which we have to contend or of which we hope to take advantage.

The principles under consideration are of no less importance to the crown and bridgeworker. The position is taken by many excellent men that the pulp of every tooth condemned to receive a cap crown should be removed, believing that the pulp of every tooth so crowned will eventually die. Beyond the fact that teeth which are crowned are generally more extensively decayed than others, I can see no reason for this opinion. I suggest that the secret may be in an inarticulating occlusion. We began making crowns upon ideal or selected forms. This soon proved unsatisfactory, and we passed on to carving cusps to correspond to a bite taken from the occluding teeth. But suppose cusps are placed upon a tooth that occludes perfectly when the jaws are at rest, but ignores the lateral and circular sweep of the occluding cusps. A tipping or wrenching results that must either wear away the cusp or set up a disturbance that ends with the death of the pulp. Bridgework reaches its highest value in providing a substitute for lower buccal teeth. If models of natural dentures that have lost one or two lower molars or bicuspids be placed in anatomical articulators it will frequently be found that the tipping of the remaining teeth has destroyed effectual articulation. The teeth can be chopped up and down, but the lateral grind of the cusps upon which mastication so much depends is very imperfect. None so well knows the value of a small grinding space as does the victim of artificial teeth, or he whose articulation has been destroyed by extraction. In constructing such a bridge it is worth while to place the models upon an anatomical articulator, and by the aid of its movements and careful attention to the smallest factors secure the

greatest amount possible of the scissorlike action of the cusp, for the action of a very few cusps toward each other may determine the value of a bridge and really stand between the patient and ill health.—*Review.*

ANNEALING GOLD FOIL. By J. R. Callahan, D.D.S. Read before the Ohio State Dental Society, December, 1902. Annealing the various forms of gold used for filling teeth has become an interesting study to me. In looking over the literature bearing on this subject I have been surprised at the brief and incomplete treatment given to it by all the authorities consulted, except Dr. C. N. Johnson, who, in following the teaching of Black and others, has added much that is important. To this chapter I hope to add a mite. "We know that two pieces of perfectly pure and perfectly clean gold will weld. Two pieces of gold foil in this condition can not be rubbed together without sticking." (Dr. C. N. Johnson: *Principles and Practice of Filling Teeth.*)

If pure gold foil is exposed to the atmosphere for any length of time, or is brought in contact with certain gases, it gathers upon its surface an imperceptible film which, while not affecting the purity of the substance itself, interferes with its cohesion. To drive off this gas and thereby restore the cohesive properties of the gold we resort to annealing. Ordinarily this is attempted by passing the gold through an alcohol or gas flame. It is well known that we seldom have a pure alcohol or gas flame. Frequently other or additional gas films are added to the gold surface, and the latter stage is worse than the former so far as cohesion is concerned. But even if we should have a pure flame it is almost impossible to pass the gold through it in a manner that will anneal evenly all portions of the strip or pellet. Consequently each layer of gold has different cohesive properties. A serious difficulty will be found at the extreme ends of the strip where the gold is so often melted.

When it comes to annealing pellets or crystal gold the flame is still more objectionable. A great improvement over the flame may be obtained by arranging a platinum tray over a flame and heating the gold thereon. The only perfect heat for annealing purposes is obtained by "electrically heating a mat of coiled platinum wire. This gives a clean, uniform and accurately controlled form of heat. Electric heat differs from all other forms of heat in that it is not

itself a form of combustion. It does not consume and does not emit, but radiates a pure heat." (Dr. L. E. Custer.) So in the electric annealer we have an ideal heat for annealing purposes. This annealer, as prepared for the market, gives that degree of heat which is probably best adapted to light foils. I believe it would be a great improvement if, with the assistance of a rheostat, the annealer were capable of giving a wider range in the intensity of the heat—an improvement that could be easily made.

All authorities with whom I am acquainted speak of annealing gold as if the purifying of the surface were the sole purpose of heating the foil, but to me this is not the only purpose or result. The microscopic structure of pure gold shows well-defined, large crystals with sharp angles, the faces of which show different shades of color from yellow to almost black. This is probably due to the presence of small secondary crystals, apparently cubes and octahedra, for it is well known that gold crystallizes in the cubic system, being found native in this form. (*Metallography,* by Arthur H. Hirons.)

If a metal naturally assumes a crystalline structure the molecules which are the component parts of matter probably also assume the definite shape, and arrange themselves in contact with each other so as to form larger crystals of the same shape, and the slower and more uninterrupted the action the larger will the crystals grow, and the more symmetrically will they arrange themselves in relation to each other. If a metal is submitted to pressure not only will the individual crystals be distorted but the orderly arrangement of the whole mass will be disturbed, and when the pressure is carried on to a certain extent the metal becomes rigid, a state of unstable equilibrium being brought about.

Now, in all probability the natural crystalline condition is the stable condition, and any deviation from this may be said to be unnatural. In such a case the molecules are ever tending to pass back again to the normal and more highly crystalline state, which is perfectly effected by remelting and often in a great measure by annealing.

Gold as prepared for filling purposes comes to us in two forms, speaking broadly, in crystals and in foil. The crystal gold is a mass of minute crystals thrown down in an irregular mass by chemical means. Foil is also a mass of crystals that has been brought together in a regular and compact or normal form by melting, this crystalline

formation having been disturbed and distorted by hammering or rolling into foil, and the crystals being partially readjusted at intervals by annealing. We have been in the habit of annealing all our gold in pretty much the same manner. That I believe to be an error which should be speedily remedied.

I believe a little experience will show that the nearer gold is to the normal crystalline condition the less heat it needs, and the farther it is from the normal crystalline condition the more protracted and the higher heat it will need for perfect results. This can not be obtained except on an electric annealer, with a high or low heat controlled by a rheostat.

Acting upon this belief I tested three of the electric annealers offered for sale at the dental supply houses. The first test was with thermometers, but these were not satisfactory because above 600 degrees the instruments did not behave well. I then tried a pyrometer—an instrument of great accuracy, with the following results. The annealers shall be known as A, B and C. The readings were taken with the covers off, for the reason that the busy dentist has enough to bother him without stopping to remove a hot cover from the annealer every few minutes.

	A		B		C
MIN.	REGISTERED.	MIN.	REGISTERED.	MIN.	REGISTERED.
1.	0° Fr.	1.	140° Fr.	1.	266° Fr.
2.	68° Fr.	2.	177° Fr.	2.	464° Fr.
3.	104° Fr.	3.	212° Fr.	3.	536° Fr.
4.	122° Fr.	4.	212° Fr.	4.	599° Fr.
5.	140° Fr.	5.	230° Fr.	5.	653° Fr.
6.	176° Fr.	6.	239° Fr.	6.	680° Fr.
7.	188° Fr.	7.	248° Fr.	7.	707° Fr.
8.	212° Fr.	8.	248° Fr.	8.	718° Fr.
9.	224° Fr.	9.	248° Fr.	9.	752° Fr.
10.	236° Fr.	10.	260° Fr.	10.	764° Fr.

I will not claim these readings to be absolutely correct from a strictly scientific standpoint, but they do show the correct relative heat-giving capacity of each instrument, and are near enough to scientific correctness for the purpose of this paper. If the test were continued for fifteen minutes or longer the annealers would show greater heat, but below the ten-minute mark A and B showed very irregular action, and owing to the limited time at my disposal the

readings are given to the ten-minute limit. At this point they were all showing rather steady progress.

In daily practice we find that each brand of gold shows an individuality that is very marked. To develop to the maximum the cohesive properties of the various brands of gold I beg to offer the following suggestions as to degrees of heat and time of exposure:

Crystal gold about 400° for one-half minute.
Soft pellets about 500° for two or three minutes.
Foil ribbons (No. 4-6) 600° for three or five minutes.
20 to 40 foils 800° for five or fifteen minutes.
60 to 120 foils 1,000° for ten or fifteen minutes.
No. 60 gold and platinum 1,000° to 1,200° ten to twenty minutes or until the gold on the surface shows a crystalline surface.

These figures are given more to make clear the idea than to establish the exact degree of heat or time of exposure. It will be seen that I prefer an annealer that will give a greater heat than any instrument on the market gives. I have in my office an annealer that will fuse gold. This being controlled by a rheostat enables me to get the greatest cohesion with any gold I desire to use. With this advantage 120 foil or 60 platinum and gold can be packed with the same force of blow that is required for No. 4 foil, and produce a more perfect and substantial filling.—*Register.*

Discolored Teeth.—G. Leist (Berlin, *Pawelz Zahntechnische Reform*) suggests treating badly discolored front teeth by burnishing a piece of platinum, or platinum-gold foil over the tooth and covering this with low-fusing porcelain body of the color desired, the whole when finished being cemented on to the tooth. The author claims that the result is durable.

Original Habitat of Man.—Professor Dyche, of the University of Kansas, advances the theory that the first man inhabited the northern part of Greenland and the territory surrounding the poles. In a recent trip to the northern part of Greenland Professor Dyche found fossil specimens of the California redwood tree. As an illustration of the fight of animals against advancing inclement nature Professor Dyche cites the case of the mammoth, which was at first a heat-loving animal. Those which refused to leave their northern home gradually grew hair as a protection. When the environment became too severe the species perished. Professor Dyche draws conclusions from the flight of birds. He believes that birds migrate north to breed because of an instinct acquired by centuries of returning to the original breeding-grounds in the north.—*New York Sun.*

Letters.

THE BOSS TRIES A NOVEL EXPERIMENT.

(AS TOLD BY THE OFFICE BOY.)

Dock Measley come over to our offis one day, an' he had his new Phonograph, what he keeps in his offis to amuse his Patients. Says he, settin' it down, "Dock Contour, I've got a New Scheme fer you, a Reel Brilliant Trick, an' I want you to try it on. Now listen:"

So then he went on to explain how he'd Often Noticed the Boss hadn't no Nerve in handling Patients, an' he never seemed to know what was the Right Thing to say in Critical Emergencies, an' so he was bound to Help him. The Boss he seemed a bit Offended when Dock Measley said that, but then he knowed well enough it was True, an' he cooled off presently.

"I've noticed you let people come in an' Sass you, an' afterwards you'll tell me what you're agoin' to say the nex' time it happens, an' then I don't never hear of your sayin' it," said Dock Measley, "so now I've got a Dandy Plan—It's this: I'll fix up a lot o' Speeches appropriate fer you to Fire off when Sassy Patients comes in, an' I'll recite them, an' you kin repeat them after me, talkin' into the Phonograph, don't you see. Then when the Proper Time comes, you have the Phonograph concealed behind your Screen, an' you set it agoin' an' let it Fire Off your speech fer you."

The Boss he Took to the Scheme right away, an' so Dock Measley he had him stand in front of the Phonograph, an' he started in givin' him Lessons, so to speak.

"Now, one o' the Best Speeches to make early in a Interview with a Sassy Patient, say it's a Woman, fer instance, is somethin' like this," said Dock Measley: "You kind o' raise your Hand, in a Authoritative Gesture, an' you say, 'Pardon me, madame, but before you proceed further allow me to suggest that you seem to have hardly the degree of respect for me that I have for myself.'" The Boss beamed with Admiration. "That certainly is a Daisy Speech," says he.

"You bet it is," said Dock Measley. "I've had Women come in a-callin' me a Hoss-Thief an' a Bugler, an' all sorts of Abuse, an' sayin' they hadn't no intention of ever payin' the Bill, an' then I'd Turn In an Alarm like that—what you might call a Ten Stroke

Alarm, callin' out the Entire Force—with Astonishin' Results. I've had them Apologize, an' then they'd pay the Bill right away, an' ast me how mutch it was fer this Consultation, an' perhaps make Appointments fer Three Members of the Family."

"Is it Possible!" exclaimed the Boss. "Fer the Land's Sake, w'y haven't I never been told this Before. It would of been Thousands o' Dolers in my Pocket." So then the Boss he was All Impatience to Git to Work, an' he repeated the sentence after Dock Measley, into the Phonograph.

"Hold on, though," said Dock, "that ain't Haf Impressive enough. You must Raise your Chin more, an' pitch your Vois lower, when you say it, an' you mustn't Twitch er act Nervous, but you must be Clam an' Composed, an' say it in a Dignified Tone." So then Dock Measley he put a new Cylinder in the Phonograph, an' before he started it agoin' he made the Boss repeat the Speech after him, till he'd got it Perfect in all respects.

It was a Pleasure to watch the Boss, he seemed Perfectly Delighted, an' as Dock Measley learned him one Speech after another, he said, "This is certainly the Prize Conception of the New Century —that is, fer Dentists that has decided not to submit to bein' Abused. It makes me Laff to think what a Bulge I'm agoin' to have on Mis' Tormbrewer the nex' time she comes here. I'll learn her to be Impudent an' Insultin' to a Honest an' Respectable member of a Honored Perfession!"

So Dock Measley he said while he was about it he'd Fit Out the Boss with a Entire Outfit o' Phrases suitable fer any conceivable Emergency. The Job took up nearly the Entire Forenoon, but when it was all Finished you could Easy See that Dock Measley felt he was Amply Repaid, seein' what a Enormous Help it was certain to be to the Boss.

"Now another thing," says he, in conclusion, "of course Mutch Depends on how you manage this Scheme. You kin place the Phonograph behind your Screen, clost to your Chair, an' when you Start it Agoin', you must look the Insulter straight in the Eye, an' never Wince ner Waver the least bit. You'd best make your Lips move, so as to help out the Illusion."

So the Boss said he would, an' he was so Excited he couldn't hardly eat his Dinner, an' he said, "James, I'd give a Doler ef Mis' Tormbrewer would happen in this very Afternoon, an' you'd see

what would Happen then. I've jis' had a Plenty of her Browbeatin' me. Of course she won't come, though, now that I reely want her to."

Well, you know how it happens sometimes; you'll be thinkin' about somethin' unpleasant that might happen to you, an' you'll torment yourself fer days, a-stewin' over it, an' then you'll Git Mad at yourself an' you'll say, "Fudge, what do I need to Fret Myself about that fer! It ain't no more likely to happen than I am to ketch the Mumps." Then right away, you ketch the Mumps, an' the other thing happens too.

It seemed Offul Funny, but that's the way it Happened this time. The Boss hadn't hardly said that when we seen Mis' Tormbrewer a-comin' up the Steps. In spite of all his Bold Talk, you could see the Boss begin to Shrink, an' Shrivel Up, like a Worm does when you hold him on a Shovel over Hot Coals. I let her in, an' the Boss, all a-smilin' says he, "Good Afternoon," like he was Offul Glad she'd come. But Mis' Tormbrewer she never answered, only she looked like she was a-saying', "Jis' you wait a Minute, an' you'll see, Mister."

So then she commenced pullin' off her Gloves, to git a Good Ready. (Women mos'ly takes off their Gloves, whether they're a-goin' to stay All Day, er only make a Appointment. It seems like they enjoy keepin' Dentists waitin', an' hender them workin' fer anybody else, an' so they take off their Gloves so as to have a Excuse fer hangin' round in the Dentist's way, while they're puttin' them on agin.)

Mis' Tormbrewer's looks was Reel Squally, an' the Boss's expression was a Caution. There's a Book that lays on the Table in our Reception-Room, an' it's full o' Pictures o' people gittin' Biled to Death, an' pinched with Red-Hot Tongs, an' it's all about the Christian Martyrs. One man that looks like the Boss is a-layin' on a Table, an' they're a-borin' a Hole in his Stummick with a Auger, an' it looks like he is a-sayin', "Please don't do that." An' that's jis' the Way the Boss was a-lookin' now.

In short the Boss he was Badly Rattled, an' it seemed like he'd fergot all about the New Scheme. So when Mis' Tormbrewer had got her Gloves Off, says she, "What's the matter of your Work, anyhow, Dock Contour? These Teeth you made fer me ain't no Earthly Good. All my friends says they make me look Fifty Years

old." (Blamed ef I wouldn't of said that was a Improvement, sense the ones the Boss pulled out fer her, easy made her look Sixty.)

I was a-lookin' to see the Boss go behind the Screen an' set the Phonograph so as it would Go Off. But he acted like he'd Clean Fergot we had a Phonograph, so I went behind the Screen an' I set it all ready to Fire off. The very first words the Boss spoke showed he had fergot, Sure Enough. Says he, "I'm dreadful Sorry, Mis' Tormbrewer, an' I hope you won't be so Offul Hard on me, fer at the best us Dentists has Tuff Times a-tryin' to suit everybody. Though ef you want to know the truth, I'll say I reckon them teeth ain't so Mutch too Old fer you."

That was probably the most Unfortunate Speech the Boss could of made. It set Mis' Tormbrewer off in a Instant. Says she, "Well, upon my Word! So it ain't enough fer you to make Teeth fer me that everybody says is too Old fer me, but you have to take on a Perverse Streak an' insist they're about Right! I wasn't never so Insulted in all my Born Days, never! How dare you!"

The Boss he was Up a Tree now, sure enough, an' afeard to Come Down. So says he, "I'm a poor, mis'rable Man, an' must throw myself wholly on your Compassion. Ef you'll kindly try an' overlook this Lapse, I promise you I'll spare no Effort to right this Blunder, an' see that you git Full Satisfaction fer the trouble an' moritfication you must of Suffered from, Mis' Tormbrewer."

The Boss wiped his Brow, an' it did seem like he was reely sweatin' Blood, he was in sech Turrible Distress. But Mis' Tormbrewer she didn't show no signs of Lettin' Up, but went on a-cussin' him in Genteel Female Language. All the time I was a-fixin' the Phonograph, an' a-wonderin' which Speech was the Most Appropriate to put in, fer a Man bein' abused an' Misused like the Boss jis' then was. So while I was a-hesitatin' not reely knowin' what was the Best One, I must have teched the Spring, fer derned ef the Blamed Thing didn't Go Off an' begun a-stringin' off a Speech in a Deep, Impressive Base Vois. Comin' right on top o' what the Boss had jis' the instant before said, it certainly did sound Funny. It said: "I think you know me well enough, Madame, to understand that I will not Submit to be Browbeaten in my own Office. I am not aware that I ever solicited your Patronage, an' if my services are not satisfactory, the city is full of Dentists, and probably you had better seek another Office."

When the Machine commenced talkin' you could see the Boss give a Start. But he had the Presents of Mind to keep his lips a-movin', though what he was reely a-sayin', Private an' to himself, was somethin' you wouldn't hardly expect to find in no book o' Stories fer Good Boys. Mis' Tormbrewer she looked Offul Supprised an' Indignant, an' she couldn't say a Word fer a Moment. Then she Recovered her Vois. Says she, "Well, I kin easy find plenty o' Dentists that I reckon could give you lessons in any line o' the Business, an' after this Job is Made Right I promise you I'll do that Very Thing. Meanwhile this Work isn't Satisfactory, an' the Bill will not be paid, not a cent of it, Sir, until you give me an' my Friends full Satisfaction."

Mis' Tormbrewer she Set Down in a Chair, an' she tapped with her Foot, an' tossed her head reel Sassy, an' as good as Dared the Boss to Take it Up. The Boss he was of Course filled with Consternation. He was Offul White about the Mouth, an' he tried in Vain to speak. Then jis' as it seemed like he was gittin' so as he could reely Speak, I touched off the Phonograph agin. It said: "Unless there is some special understanding to the contrary, my terms are cash when the work is done. We dentists are not Capitalists, and our accounts are not supposed to be open accounts, which may be settled very six months, and instead of being the last to be Paid, we should be the First. Therefore, I must ask you kindly to pay me, at Once."

When Mis' Tormbrewer heered that she got Blazin' Mad. Says she, "It seems like you've had somebody teachin' you a set o' Rules to regulate your Actions, an' I'd say that was a Offul Good Thing, sense you don't seem to have no Principle, er no Principles either. But ef I was you, I'd have the Party what learned you to Repeat them sayings, to learn you somethin' like Common Sense in usin' them. He'd orter learned you some o' the Things People might take a Notion to say back to you. Fer instance: 'Us folks that patronize Dentists isn't Millionaires, an' ef we was, we wouldn't pay fer things that didn't Suit, an' we might even leave them on your Hands'—like I'm a-goin' to do with these Teeth."

Mis' Tormbrewer smiled Sarcastic. The Boss he Trembled, fer he knowed Well Enough there wasn't no Deposit made when she ordered the Set. An' sure enough, she took out the Teeth an' slung them in the Boss's Waste-Basket. Then she Went Out, sniffin' offul

Scornful. Says she, without turnin' her head, "You may find that you Regret your Insolence, sir! But that will not help you in the least, sir, not in the least. Ahem!"

So then I teched the Trigger an' set the Phonograph off again at Random, as you Might Say. An' what it said tickled the Boss so he said he was Repaid a Thousand Fold fer the distress he had suffered up to that instant. It said: "Some People come in here with the Conceited Notion that when they withdraw their Patronage the dentist has no recourse but to Hike Away to the Poor-House."

Cincinnati, O. FRANK W. SAGE, D.D.S.

WHAT A DENTIST SHOULD NOT DO.—(Dr. E. T. Darby, in *Penn Dental Journal.*)—He should never approach a patient with unwashed hands, unclean nails or soiled linen.

He should never approach a patient without a clean napkin in his left hand and a mouth mirror in the right.

He should never put his finger in a patient's mouth when an instrument or mirror will do as well.

He should never undertake the operation of filling until all salivary calculus has been removed, the teeth thoroughly cleansed and the gums made healthy.

He should never apply the rubber dam to a single tooth in preparing or inserting a filling when it is possible to include the adjacent teeth.

He should never attempt to make arsenical applications in inaccessible cavities without having first applied the rubber dam.

He should never apply arsenious acid to a congested pulp.

He should never attempt the treatment of pulpless teeth until he has thoroughly cleansed the carious cavity.

He should never hermetically seal a pulpless tooth when putrescent pulp tissue remains in the canals or where gases from the decomposition of the pulp are suspected.

He should never attempt the treatment of pulp canals without the rubber dam upon the tooth.

He should never leave caries in any part of a cavity even though its removal would result in the exposure of the pulp.

He should never attempt to cap pulps which have been exposed for any great period of time and have been the seat of pain.

He should never use powerful drugs carelessly.

He should never deceive his patients or in any way take advantage of their ignorance.

He should never forget that the poor and needy are entitled to the same courteous consideration which is shown the rich and influential.

He should never use tobacco until his day's work is done.

He should never forget that the dentist is expected to be a gentleman.

The Dental Digest.

PUBLISHED THE FIFTEENTH DAY OF EVERY MONTH
At 2231 Prairie Avenue, Chicago,
Where All Communications Should be Addressed.

Editorial.

THE MEETINGS RECENTLY HELD AT ASHEVILLE.

The National Association of Dental Faculties gave especial attention to the four-year course, and it is now believed that it will go into effect, although many college men predict that it will ultimately be abandoned, for the majority seem to believe that it is a mistake to add this fourth year. Reviewing the professional careers and attainments of those men who entered the profession forty years ago, after a two years' course of four months each in many cases, we are forced to the conclusion that the majority of them are more skillful operators and better professional men than the average of those now being graduated under a three years' course, with all the additional equipments and facilities for teaching. It is not our intention to urge that a student will accomplish more in eight months' training than he would in twenty-eight, but if the colleges cannot make dentists out of the material they admit to their classes in three years they cannot do so in four. Three years of purely technical work would be sufficient if the students had minds broadened by previous study. We would urge higher entrance requirements rather than longer technical courses. In this connection we would recommend to the attention of our readers the admirable if radical ideas set forth by Dr. Carlton on page 998 of this issue.

The Dental School of Harvard University withdrew from the Association. It will not add a year to its course, giving as a reason that it now has nine months in a course while other schools have seven, and also has higher entrance requirements.

The Association voted an additional assessment of $100 on each college to carry on the work of the Prosecuting Committee of the National and Faculties' Associations.

The National Association of Dental Examiners entered upon a radical course of action which when completed is bound to work great improvements in the profession. We will discuss this matter

later. The following resolution on interchange of license was unanimously adopted—"That an interchange of license to practice dentistry be and is hereby recommended to be observed by the various state boards on the following specific conditions: Any dentist who has been in active practice for five years or more, is a reputable dentist, is a person of good moral character, and is desirous of making a change of residence, and has in his possession already a certificate, may apply to the board of the state in which he is a resident for a new certificate, which certificate if granted may be deposited with the examining board of the state in which he proposes to reside, and said board in lieu thereof may grant him a certificate allowing him to practice." This resolution has been passed by the New Jersey Board, and two states—Ohio and Indiana—have already entered into an agreement on this plan.

As regards the National Dental Association, the attendance was large and there was a goodly addition of southern men of ability who had never met with the body before. Not nearly so many eastern men attended this year as usual, but we believe the Association strengthened itself by going as far South as it did. How the scientific part of the proceedings will compare with other years can be determined by comparison later, but we are under the impression that this year was not up to the average, which would indicate a lack of sufficient effort on the part of the chairmen of some of the sections, and other officers. The program was arranged to give two half days to clinics, which was a mistake, for we do not believe the National should hold clinics at all. In this connection we wish to enter a vigorous protest against the practice of allowing dental supply men to advertise their wares at the expense of the Association and to have their names put on the program for clinics. Men having cement, amalgam and other goods to sell should buy space with the exhibitors and take their places with them instead of parading before the Association in the guise of clinicians. This same abuse prevails in many state societies and should certainly be remedied.

The most important action taken by the National this year was the adoption of new rules governing its proceedings, which consolidates the six sections into three, and anticipates having no papers read before the main body except an occasional address, although it is not indicated what that may be. All the other papers are to be read in the different sections to which they belong.

The plan adopted, which is to go into effect at the next meeting, is copied, as we are well aware, from that of a very successful organization—the American Medical Association—but the advocates of this plan seem to lose sight of the fact that this Association has over thirty thousand members, and it would be impossible to hold all its meetings in one room and have all its papers read before the main body. The National, however, has a membership of less than four hundred, not more than two-thirds of whom are ever present, so it could well have all the important papers read in the general meeting. The original idea of having six sections was that the members of same would be doing scientific work during the year and be prepared to report at subsequent meetings, but this has never been carried out to any great extent. Nevertheless, with the present small membership in the Association we believe the meetings would be more successful under the old plan than under the new.

BROADEN YOUR VIEWPOINT.

On page 943 of this issue we publish a short paper by Dr. Peirce. It has no direct reference to dentistry, but we believe it would be well for the dentist to occasionally look over the border line and thus broaden his vision. The title of the paper is "Mental Traits;" there are probably few who could look carefully over and analyze their own actions and reasons for the same without feeling that something had been gained which would at some time prove advantageous. We touched last month on this matter of dentists going outside the boundaries of purely professional work once in a while, so we will not repeat, except to say that dentistry pure and simple cannot help but narrow a man if he devotes himself entirely to the technical side of it. He who broadens his viewpoint will prove the better practitioner and will derive much more enjoyment from life than he who does not.

Notices.

MINNESOTA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the Minnesota State Board of Dental Examiners will be held Oct. 6, 1903, at the Dental Department of the State University at Minneapolis. Candidates should bring their diplomas, also instruments for insertion of a gold filling. C. H. ROBINSON, Secy., Wabasha.

SOUTHERN CALIFORNIA DENTAL ASSOCIATION.

The sixth annual meeting of the Southern California Dental Association will be held in Los Angeles, at the Dental College of the University of Southern California, Sept. 28-29, 1903. All ethical practitioners are cordially invited to attend. LEWIS E. FORD, Secy., Los Angeles.

WISCONSIN STATE DENTAL SOCIETY.

At the thirty-third annual meeting of the Wisconsin State Dental Society, held at Superior July 21-23, 1903, the following officers were elected: Pres., A. G. Fee, Superior; 1st V-P., F. G. Van Stratum, Hurley; 2d V-P., J. V. Miller, Manitowoc; Secy., W. H. Mueller, Madison; Treas., A. Gropper, Milwaukee. The next meeting will be held at Manitowoc the third Tuesday in July, 1904. W. H. MUELLER, Secy.

NATIONAL ASSOCIATION OF DENTAL EXAMINERS.

At the annual meeting of the National Association of Dental Examiners, held at Asheville, N. C., July 24-27, 1903, the following officers were elected: Pres., B. L. Thorpe, St. Louis; V-P. from west, J. G. Reid, Chicago; V-P. from east, J. Tenney Barker, Wallingford, Conn.; V-P. from south T. P. Whitby, Selma, Ala.; Secy. and Treas., Chas. A. Meeker, 29 Fulton St., Newark, N. J.

MAINE STATE DENTAL SOCIETY.

The annual meeting of the Maine State Dental Society was held at Kineo, July 21-23, 1903, and the following officers were elected: Pres., F. E. Maxfield, Bangor; V-P., R. W. Bickford, Rockland; Secy., H. A. Kelley, Portland; Treas., E. J. Roberts, Augusta; Librarian, E. Bacon, Bar Mills; Ex. Com., W. S. Payson, Castine; C. H. Haines, Dexter; G. E. Dow, Portland; J W. Robinson, Auburn; W. S. Miller, Fairfield. The next meeting will be held at Bangor.

TENNESSEE STATE DENTAL ASSOCIATION.

The Tennessee State Dental Association held its annual meeting at Chattanooga, July 23-25, 1903, and elected the following officers: Pres., R. Boyd Bogle, Knoxville; 1st V-P., T. D. Townes, Memphis; 2d V-P., A. J. Cottrell, Knoxville; Rec. Secy., J. T. Crews, Jackson; Cor. Secy., W. K. Slater, Knoxville; Treas. W. P. Simms, Nashville; Ex. Com., J. R. Beach, Clarksville, Chairman; A. R. Melendy, Knoxville; P. M. Joyner, Union City. The next annual meeting will be held at Jackson.

NATIONAL DENTAL ASSOCIATION.

The annual meeting of the National Dental Association was held at Asheville, N. C., July 28-31, 1903, and the following officers were elected: Pres.,

C. C. Chittenden, Madison, Wis.; V-P. from the west, Harry P. Carlton, San Francisco; V-P. from the east, Waldo E. Boardman, Boston; V-P. from the south; J. G. Fife, Dallas, Tex.; Cor. Secy., C. S. Butler, Buffalo; Rec. Secy., A. H. Peck, Chicago; Treas., V. E. Turner, Raleigh, N. C.; Ex. Com.—C. N. Johnson, Chicago; V. H. Jackson, New York; T. P. Hinman, Atlanta; Ex. Council, H. J. Burkhart, Chairman, Batavia, N. Y.; J. Y. Crawford, Nashville; M. F. Finley, Washington; B. Holly Smith, Baltimore; Chas. McManus, Hartford.

The papers and proceedings will be published in the DENTAL DIGEST.

NEW JERSEY STATE BOARD.

The State Board of Registration and Examination in Dentistry of New Jersey will hold its semi-annual examination in the Assembly Room of the State House at Trenton, October 20-23, 1903. All applicants are required to file their applications with the secretary ten days prior to the examination. The sessions begin promptly at 9 a. m. each day. Fee for examination $25. For any information communicate with the secretary.

CHAS. A. MEEKER, Secy., 29 Fulton St., Newark, N. J.

VIRGINIA STATE DENTAL ASSOCIATION.

The Virginia State Dental Association met at Hot Springs, Va., July 21-23, 1903, and elected the following officers: Pres., I. B. Smith, Richmond; 1st V-P., R. L. Simpson, Fincastle; 2d V-P., J. L. Walker, Norfolk; 3d V-P., L. M. Cowardin, Richmond; Rec. Secy., G. F. Keesee, Richmond; Cor. Secy., J. Hall Moore, Richmond; Treas. W. H. Ewald, Portsmouth; Ex. Com., E. J. Applewhite, Newport News; E. P. Beadles, Danville; A. L. Stratford, Richmond. The next annual meeting will be held at Charlottesville.

ILLINOIS STATE BOARD OF DENTAL EXAMINERS.

The next regular meeting of the Illinois State Board of Dental Examiners to examine applicants for license to practice dentistry in this state will be held in Chicago Oct. 15-17, 1903. The following are eligible to take the examination before the Board. "Any one holding a medical diploma from a reputable college; any one who has been a legal practitioner of dentistry for ten years prior to moving into this state, and anyone who failed to register in this state at the time the law went into effect in 1881."

Candidates must furnish their own patients and come provided with the necessary instruments, rubber dam and gold to perform practical operations and such other work as is deemed advisable by the Board. Those desiring to take the examination should matriculate with the secretary at least ten days before the meeting. The examination fee is $10. Any further information can be obtained by addressing the secretary.

J. G. REID, Secy., 1204 Trude Bldg., Chicago.

FOURTH INTERNATIONAL DENTAL CONGRESS.

August 29 to Sept. 3, 1904.

Committee of Organization of Fourth International Dental Congress: H. J. Burkhart, Chairman; E. C. Kirk, Secretary; R. H. Hofheinz, Wm. Carr, W. E. Boardman, V. E. Turner, J. Y. Crawford, M. F. Finley, J. W. David, Wm. Crenshaw, Don M. Gallie, G. V. I. Brown, A. H. Peck, J. D. Patterson, B. L. Thorpe.

The Department of Congresses of the Universal Exposition, St. Louis, 1904, has nominated the Committee of Organization of the Fourth International Dental Congress—to be held in August, 1904, in connection with the Exposition—which was appointed by the National Dental Association, and has instructed the committee thus appointed to proceed with the work of organization of said Congress.

Pursuant to the instructions of the Director of Congresses of the Universal Exposition, 1904, the Committee of Organization presents for your consideration and information the subjoined outline of the plan of organization of the Dental Congress.

The Congress will be divided into two departments: Department A—Science (divided into four sections). Department B—Applied Science (divided into six sections).

Department A—Science.

I. Anatomy, Physiology, Histology, and Microscopy. Chairman, M. H. Cryer.
II. Etiology, Pathology, and Bacteriology. Chairman, R. H. Hofheinz.
III. Chemistry and Metallurgy. Chairman, J. D. Hodgen.
IV. Hygiene, Prophylaxis, Therapeutics, Materia Medica, and Electrotherapeutics. Chairman, A. H. Peck.

Department B—Applied Science.

V. Oral Surgery. Chairman, G. V. I. Brown.
VI. Orthodontia. Chairman, E. H. Angle.
VII. Operative Dentistry. Chairman, C. N. Johnson.
VIII. Prosthesis. Chairman, C. R. Turner.
IX. Education, Nomenclature, Literature, and History. Chairman, T. W. Brophy.
X. Legislation. Chairman, Wm. Carr.

Committees.

The following committees were appointed:

Finance. Chairman, C. S. Butler.
Program. Chairman, A. H. Peck.
Exhibits. Chairman, D. M. Gallie.
Transportation. (To be appointed.)
Reception. Chairman, B. Holly Smith.
Registration. Chairman, B. L. Thorpe.
Printing and Publication. Chairman, W. E. Boardman.

Conference with State and Local Dental Societies. Chairman, J. A. Libbey.
Dental Legislation. Chairman, Wm. Carr.
Auditing. (Committee of Organization.)
Invitation. Chairman, L. G. Noel.
Membership. Chairman, J. D. Patterson.
Educational Methods. Chairman, T. W. Brophy.
Oral Surgery. Chairman, G. V. I. Brown.
Prosthetic Dentistry. Chairman, C. R. Turner.
Local Committee of Arrangements. (To be appointed.)
Essays. (To be appointed.)
History of Dentistry. Chairman, Wm. H. Trueman.
Nomenclature. Chairman, S. W. Foster.
Promotion of Appointment of Dental Surgeons in the Armies and Navies of the World. Chairman, Wms. Donnally.
Care of the Teeth of the Poor. Chairman, Thomas Fillebrown.
Etiology, Pathology, and Bacteriology. Chairman, R. H. Hofheinz.
Prize Essays. Chairman, James Truman.
Oral Hygiene, Prophylaxis, Materia Medica, Therapeutics, and Electrotherapeutics. Chairman, A. H. Peck.
Operative Dentistry. Chairman, C. N. Johnson.
Resolutions. Chairman, J. Y. Crawford.
Clinics. Chairman, C. E. Bentley.
Nominations. (To be appointed.)
Local Reception Committee. (To be appointed.)
Ad interim. Chairman, G. V. I. Brown.

The officers of the Congress, president, vice-presidents, secretary and treasurer will be elected by the Congress at large at the time of the meeting, and will be nominated for the several positions by the nominating committee.

The Fourth International Dental Congress will be representative of the existing status of dentistry throughout the world. It is intended further that the Congress shall set forth the history and material progress of dentistry from its crude beginnings through its several developmental stages, up to its present condition as a scientific profession.

The International Dental Congress is but one of the large number of congresses to be held during the period of the Louisiana Purchase Exposition, and these in their entirety are intended to exhibit the intellectual progress of the world, as the Exposition will set forth the material progress which has taken place since the Columbian Exposition in 1893.

It is important that each member of the dental profession in America regard this effort to hold an International Dental Congress as a matter in which he has an individual interest, and one which he is under obligation to personally help toward a successful issue. The dental profession of America has not only its own professional record to maintain with a just pride, but, as it is called upon to act the part of host in a gathering of our

colleagues from all parts of the world, it has to sustain the reputation of American hospitality as well.

The Committee of Organization appeals earnestly to each member of the profession to do his part in making the Congress a success. Later bulletins will be issued, setting forth the personnel of the organization and other particulars when the details have been more fully arranged.

H. J. BURKHART, *Chairman,*
E. C. KIRK, *Secretary.*

Approved:

HOWARD J. ROGERS, *Director of Congresses,*
DAVID R. FRANCIS, *President of the Exposition.*

News Summary.

A. D. BARRETT, a dentist at Norfolk, Va., was recently declared insane.

C. A. BOOREN, 37 years old, a dentist at New Orleans, died July 29, 1903.

W. C. WICKINS, 64 years old, a dentist at Minneapolis, died Aug. 4, 1903.

G. W. WERTZ, 58 years old, a dentist at Omaha, Neb., died Aug. 9, 1903.

C. S. CADY, 66 years old, a dentist at Rochester, N. Y., died Aug. 17, 1903.

E. L. MASON, 33 years old, a dentist at Rockland, Me., died July 28, 1903.

EDMUND EATON, 54 years old, a dentist at Livermore Falls, Me., died Aug. 1, 1903.

J. W. STROH, 29 years old, a dentist at Cincinnati, committed suicide Aug. 7, 1903.

F. Y. CLARK, a retired dentist at Saratoga, N. Y., 74 years old, died Aug. 21, 1903.

W. C. HENSLEY, a dentist at Kansas City, Mo., died of typhoid fever, July 22, 1903.

LOUIS SHAW, 52 years old, a dentist at Brooklyn, committed suicide July 25, 1903.

H. C. CONNOR, 30 years old, a dentist at Louisville, Ky., committed suicide Aug. 17, 1903.

JOHN B. PATRICK, 81 years old, a retired dentist at Charleston, S. C., died July 20, 1903.

J. B. RAWSON, 80 years old, a retired dentist at Jamestown, N. Y., died July 21, 1903.

H. H. WALTHAM, a dentist at Long Hollow, Ky., was adjudged insane July 24, 1903.

J. A. BALLENTINE, a dentist at Jonesboro, N. C., died Aug. 21, 1903, of Bright's disease.

"A CONSERVATIVE is a man who is too cowardly to fight and too fat to run."—*Philistine.*

ARCHIE BOALS, 33 years old, a dentist at Cleveland, O., died Aug. 9, 1903, from throat trouble.

H. E. LEHR, 26 years old, a dentist at Dwight, Ill., died July 30, 1903, from consumption.

C. M. CLOUGH, 28 years old, a dentist at Minneapolis, died July 30, 1903, after a long illness.

F. R. WRIGHT, 36 years old, a dentist at Wapello, Ia., died Aug. 17, 1903, after a long illness.

A. M. KUNTZ, 52 years old, a dentist at Patchogue, L. I., died Aug. 19, 1903, from paralysis.

A. M. NEWMAN, a dentist at Providence, R. I., was killed in a baseball game, Aug. 22, 1903.

H. D. OSGOOD, 67 years old, a dentist of Boston, died Aug. 22, 1903, from cancer of the stomach.

J. C. TRUBY, 30 years old, a dentist at New Brighton, Pa., died Aug. 12, 1903, from appendicitis.

H. H. OLNEY, 46 years old, a dentist at Leavenworth, Kan., died Aug. 2, 1903, from tuberculosis.

F. L. MORHARD, a dentist of New York City, was killed July 31, 1903, by touching a live electric wire.

G. J. BOEHRING, 23 years old, a dentist at Kansas City, Mo., died Aug. 12, 1903, from typhoid fever.

E. W. RUSSELL, 29 years old, a dentist at Livermore, Cal., died July 10, 1903, from typhoid pneumonia.

G. A. MCNEILLE, 47 years old, a dentist at Seymour, Conn., died July 23, 1903, from intestinal inflammation.

E. L. CLIFFORD, 47 years old, a dentist at Chicago, died Aug. 14, 1903, from an accidental overdose of morphin.

THE PAIN a dentist causes is remembered longer than any suffering he may have prevented.—*Sat. Eve. Post.*

ACCIDENT.—Last month a dentist at Dayton, O., narrowly escaped being seriously injured when his vulcanizer exploded.

RECEDING GUMS.—Apply glycerite of tannin to spongy gums as a tonic astringent lotion. It reestablishes the nutritive function.—*Register.*

JAMES H. BLAISDELL, a young dentist of New York, was drowned Aug. 24, 1903, while trying to save the life of a drowning woman at Ashbury Park.

DELICATE TOUCH.—To retain delicacy of touch and extreme sensitiveness of finger-tips, bathe your hand once weekly with fine sand.—*Sur. Clinic.*

ACCOMMODATED.—"I can pull you through," said the doctor. "Try and pull both legs alike," said the patient; so the doctor doubled the bill.—*Alk. Clinic.*

TO REMOVE ADHERING PLASTER FROM VULCANITE PLATES.—Place the

plate for a short time in water containing a small quantity of sulphate of potassium.—Dr. Isham, *Forum.*

W. C. Barrett.—Just at time of going to press we have received a report that Dr. W. C. Barrett of Buffalo, prominent in college and society affairs, died Aug. 22, 1903, in Germany.

Springfield (Ill.) Dental Society elected the following officers at its last annual meeting: Pres., Grafton Munroe; V.-P., E. Lambert; Secy., J. R. Lieb; Treas., E. A. Kartack.

Teller County (Col.) Dental Association was organized July 30, 1903, and the following officers were elected: Pres., John Drury; V.-P., J. C. Seymour; Secy. and Treas., M. Catlett.

American Medical Association Honors Paris Dentist.—At the recent meeting of the Section of Stomatology, American Medical Association, Dr. J. H. Spaulding of Paris was elected a "member by invitation."

To Relieve Tendency to Gag or Vomit.—(I. R. Megraw, in *Western.*) —Administer oxalate of cerium in one-grain doses, or the aromatic spirits of ammonia, one-half to two drachms in an ounce or more of water.

Bankrupt.—D. A. J. Ferner filed a petition in voluntary bankruptcy Aug. 4, 1903; liabilities, $2,238.—J. E. Wilson, a dentist of Ft. Worth, Tex., filed an involuntary petition in bankruptcy, Aug. 12, 1903; liabilities, $3,513.

To Prevent Gold Foil or pellets when being cut from adhering to shears, have sharp, smooth edge on shears, wipe clean before using, and draw the edges of the blades lightly across the finger.—R. E. Sparks, *Dom. Jour.*

Fires.—G. M. C. Barnard, Ware, Mass., Aug. 11; loss $1,000.—J. H. Case, St. Louis, Aug. 21, loss $2,000.—C. W. Graff, Tecumseh, Neb., July 20, loss $500.—W. H. Kreegan, Ware, Mass., Aug. 11; loss $1,500, insurance $900.—C. A. Philpott, Tecumseh, Neb., July 20, loss $600.

Treating an Alveolar Abscess with Formaldehyd.—A blind or chronic abscess can be treated with good results by using a three per cent solution of formaldehyd. If the pus pocket is very large, however, a one per cent solution is preferable.—Dr. W. H. G. Logan, *Review.*

To Preserve Peroxid.—It is stated that the admixture of an equal quantity of listerine with peroxid of hydrogen maintains the stability of the peroxid much longer than would otherwise obtain, and that mouth washes of alkalin reaction should not be used in combination with peroxid.

From All Parts of the World.—"Please let me say how much I like the Digest; it is bright and energetic, and I am glad to have it." *J. H. Spaulding,* Paris.—"I should not like to be deprived of the pleasure and profit I derive from the Digest." *Robert S. Ivy,* Shanghai, China.

Cough May Cause Loss of Sight.—J. B. Thompson, a dentist in Denver, is suing the Fidelity and Casualty Company, in which he has an accident insurance policy, to collect $4,875. Last August he was extracting a tooth from a woman patient, when she suddenly coughed, and projected some

poisonous matter into his eye. The member has steadily grown worse, and he is now told by oculists that he will soon be blind in that eye. The company claims that the policy does not cover such an accident, so the outcome of the suit will be watched with interest by dentists and physicians everywhere.

PATHETIC.

The window was open,
The curtain was drawn;
A microbe flew in,
And our darling was gone.—*Sur. Clinc.*

To Clean Rubber-Dam Clamps.—(F. W. Stephan, in *Review.*)—Place a number of them in the palm of the hand, add a little powdered pumice, moisten with water and work together for a few minutes; then rinse in clear water, and you will find that all the little crevices so hard to get at will be polished.

Gas Causes Trouble.—It is reported that a young man of Louisville has gone insane after having some teeth extracted under gas. Last month a young woman at Norfolk, Va., had some teeth extracted under gas and her life was despaired of for an hour afterwards, while it was several days before she fully recovered.

Northwestern Dental Journal.—The latest arrival in the dental field is the Northwestern Dental Journal, a quarterly, with Dr. G. V. Black as supervising editor, and published by the Northwestern University Dental School Alumni Association. The first issue is creditable in all respects, and we wish the newcomer all possible success.

Diplomatic.—The small boy who refused to go to the dentist because he was afraid he would give the dentist whooping cough, will be heard from in diplomatic circles, as will also the youngster who demanded from his mother 50 cents because in a fight another boy had knocked out a tooth which she intended to have extracted by a dentist.

At it Again.—Word comes from the rural districts of Illinois that a dental fakir is working the farmers on the same old swindle of "extracting teeth without cost, providing a new set is purchased," and obtaining a deposit fee, but never returning with the plate. Anyone who is foolish enough to patronize an itinerant dentist ought to be fleeced.

Fatalities.—Aug. 13, 1903, a woman in Philadelphia died under chloroform after the extraction of several teeth.—July 25, a man at Los Angeles, Cal., died from pneumonia, resulting from weakness induced by severe hemorrhage after having a tooth extracted.—July 23, a woman at Hastings, Neb., died under chloroform after the extraction of several teeth.

Divorces.—The wife of H. E. Melze, a dentist at Quincy, Ill., recently sued him for divorce, and it is reported that he has left town to escape a warrant for wife abandonment.—W. H. Simmons, a dentist at Oakland, Cal., has filed suit for divorce against his wife.—E. D. Toler, a dentist at Kansas

City, Mo., has been sued for divorce by his wife.—R. L. Walsh, a dentist at San Francisco, has been sued for divorce by his wife on the charge of cruelty.

DAMAGE SUITS.—A woman in Rochester has sued a dental parlor operator for $5,000 damages for illness resulting from the extraction of twenty-two teeth at one sitting. She should have killed him.—A dentist at Leavenworth, Kan., recently sued a woman patient for seventy-three dollars for two sets of teeth which he had made and which she had declined to use or pay for. The court allowed him thirty-eight dollars, the price of one set, and the costs of the suit.

EDITOR'S HEAVEN.—An editor who died of starvation was being escorted to heaven by an angel who had been sent out for that purpose. "May I look at the other place before we ascend to eternal happiness?" "Easily," said the angel. So they went below and skirmished around, taking in the sights. The angel lost sight of the editor and went around hades to hunt him up. He was found sitting by a furnace, fanning himself and gazing with rapture on a lot of people in the fire. There was a sign on the furnace which said: "Delinquent Subscribers." "Come," said the angel, "we must be going." "You go on," said the editor, "I'm not going. This is heaven enough for me."

ILLEGAL PRACTITIONERS.—The authorities are after a young man of Cripple Creek, Colo., for practicing dentistry without a license, and it is stated that this is not his first offense.—A dentist at Atlanta, Ga., has been arrested for practising without a license.—Aug. 21, two itinerant dentists were arrested in Nebraska for refusing to pay the occupation tax for itinerants, and were each fined $10 and costs. During the proceedings it was discovered that they were not registered in the state, so they will possibly be prosecuted on that charge.—A mechanical dentist in New York was arrested Aug. 11 for operating on patients without a license.—Aug. 22, a dentist at Washington, Pa., was arrested for failure to have a license.

OLD TEN DOLLAR BILL.

This little "poem" from the *Atlanta Constitution* will, we feel sure, touch a responsive chord:

Bills from ever' valley,
An' bills from ever' hill,
But what we all air needin' most
Is old Ten Dollar Bill!

Fer it's money makes the mare go
A-rackin' fit to kill;
An' it's "Clear the way, believers—
Fer old Ten Dollar Bill!"

CONTROLLING NERVOUS PATIENTS.—(F. H. Metcalf in *Pacific Dental Gazette.*)—The first requisite is to control yourself, and when you find that

you can no longer do this, dismiss the patient. We all at times come in contact with people who have no control over themselves, who want the best but will not stand the slightest pain. They are best described as bundles of nerves, and are liable to belong to that class who would rather nurse a pug dog than a baby. Is it our duty to undertake difficult operations at the expense of great nerve force, with results unsatisfactory at best, or shall we patch them up with plastics and recommend them to some fellow-practitioner that we have a grudge against? The dentist must indeed be a diplomat who can meet and control all classes under conditions which are often most exacting. To successfully combine gentleness and firmness is no small accomplishment.

EXAMINING BOARD AFFAIRS.—At the last meeting of the Massachusetts Board fifty-three out of one hundred and fifteen candiddates passed the examination.—At the last meeting of the Montana Board nine out of eleven applicants were successful, and the following officers were elected:—Pres., D. W. Telzer; Vice-pres., W. A. Guder; Secy., D. J. Wait, Helena; Treas., B. J. Keenan.—At the last meeting of the Ohio Board fourteen out of twenty-four applicants passed the examination.—At the last meeting of the Pennsylvania Board one hundred and eighty-nine were successful.—At the last meeting of the Rhode Island Board eleven out of twenty-four applicants passed the examination.—At the recent meeting of the Tennessee Board the following officers were elected: Pres., W. H. B. Jones; Secy., F. A. Shotwell, Rogersville.—The governor has appointed Dr. H. M. VanVoorhis a member of the West Virginia Board.

STRONG DRINK.—Dr. Bumgardner says (*Surg. Clinic*) that the following "patent" medicines contain the percentages given of alcohol:

Greene's Nervura	17.2
Hood Sarsaparilla	18.8
Schenck's Sea-weed Tonic	19.5
Brown's Iron Bitters	19.7
Kaufman's Sulfur Bitters	20.5
Paine's Celery Compound	21.0
Burdock's Blood Bitters	25.2
Ayer's Sarsaparilla	26.2
Warner's Safe Tonic Bitters	35.7
Parker's Tonic	41.6
Hostetter's Stomach Bitters	44.3

CHINESE DENTISTRY.—Dr. R. S. Ivy, one of our subscribers in Shanghai, China, sends the following free translation of a Chinese quack advertisement: "Since I was small I have studied dentistry. I graduated at a great college and have got a diploma. Since then I have practiced in China many years. My fame exists in all the provinces. Every year I visit the north. All kinds of trouble with the teeth I will cure. I fill up the holes made by worms. Toothache arises from wind and fire and worms, which eat up

the teeth. When you eat the pressure of food causes pain. I can repair these places and perpetual relief will result. Whether you have only lost a few teeth or all your teeth, I can make you a whole even set on which you can chew the toughest object. Fillings are made of gold, silver and pewter. Plates are made of gold skin or elephant skin. I can do this. This is true. Prices can be arranged to suit every one. Please come early. Signed, Ho-Ching-Toong."

PERFECT OCCLUSION.—(W. W. Evans in *International.*)—To obtain a perfect occlusion there are three things to be considered: First: A material with which to make the articulating base-plate that shall be plastic to work and sufficiently rigid to hold its form when molded and carved to suit the case, and which will withstand the heat of the mouth without undergoing change. Second: The plate or plates should be so shaped and smoothed as to be light, and to conform as nearly as possible to the finished denture, allowing for length of teeth, but without unnecessary bulk. Third: When satisfied that the bite is correct, find a means to lock the plates, if in an edentulous mouth, so that when removed the perfect occlusion may be retained without disturbance. If these rules are strictly adhered to there will be no need for mechanical articulators, nor will it be necessary to see the patient again until the work is completed, when it may be placed in the mouth without touching with the file or grindstone.

TEMPORARY CROWNS.—(H. J. Goslee in *Review.*)—As a means of relieving the patient of disfigurement and embarrassment during the construction of a permanent crown, and for the purpose of facilitating the subsequent adjustment of the same by keeping the gums packed away nicely and exposing the end of the root, temporary crowns should invariably be employed in crowning anterior teeth. This expediency can be observed and such crown constructed in a few minutes by selecting and adopting an ordinary facing, and attaching a dowel made of German silver wire of proper size. The attachment may be made by flattening and notching one end of the dowel in such manner as to engage the pins, and then bending them over upon it, or soft solder may be used if desired, and the crown then mounted with gutta-percha or temporary stopping. Whenever the time required to complete the construction of the permanent crown precludes finishing and mounting it on the same day that the root is prepared, the possible advantages resulting warrant the expenditure of time for this purpose.

CONTROL OF MOUTH-BREATHING AT NIGHT.—Stewart W. Tufts (*Amer. Med.*) believes that the most simple method for preventing mouth-breathing that can be devised is to stick a piece of silk isinglass courtplaster, about three-eighths inch by 1¼ inch, across the closed lips. It can be quickly removed, and does not irritate the lips. The writer finds that at least 90 per cent of his patients with acute and chronic diseases of the respiratory tract are mouth-breathers at night. A nose to be normal must be used constantly. If it is not so used the mucous membrane congests and gradually thickens from hypernutrition. Air inspired through the nose receives

from 20° to 40° of heat and becomes at least two-thirds saturated with moisture, and thus the nose becomes a most effective germ filter. The mouth has none of these functions, and when it is used for breathing the lungs must receive many germs and suffer injury from the unmodified air. When the immense mortality from lung diseases is considered, the importance of this subject can better be realized. Tufts finds his general results better in the treatment of respiratory diseases since the use of this method.

EVILS RESULTING FROM THE PRESENCE OF DEAD TEETH IN THE MOUTH. (T. G. Rix in *Register.*)—Physicians frequently overlook very serious conditions because of lack of knowledge of the results of the presence of dead teeth. Several months ago my attention was called to the case of a young man who had undergone a successful operation for empyema of the frontal sinuses, but the operation had left the boy blind in one eye. On examining the case I found that the upper first molar on the affected side had been treated and filled, but there was a suspicious appearance about the tooth. I had an X-ray picture made of the side of the face, which revealed the presence of an opaque condition in the antrum. The tooth was extracted and an opening made into the antrum, which was found filled with a serous and bloody fluid. This was washed out with antiseptic washes and the antral condition treated. In three weeks' time the eyesight had been restored and the antral difficulty was well under way toward cure. I find few remedies so effective for the preliminary treatment of antral troubles as aromatic sulfuric acid.

MARRIAGES.—R. G. Armstrong, a dentist of Fairview, W. Va., married Miss Delia L. Truesdell, of Beverly, O., July 22.—J. S. Anderson, a dentist of Philadelphia, married Miss Edith M. Garlick, of Rome, N. Y., Aug. 4.—W. E. Chester, a dentist of Cincinnati, married Miss Florence Edmondson, of Cincinnati, July 15.—W. A. Cox, a dentist of Moline, Ill., married Miss Berdina W. Peterson, of Moline, Aug. 13.—W. S. Conway, a dentist of Atlanta, Ga., married Miss Mary Richards, of Memphis, Tenn., Aug. 9.—W. V. Jarrett, a dentist of Richmond, Va., was married Aug. 26.—A. M. Kile, a dentist at Lovington, Ill., married Miss Evelyn Cook, of Oconee, Ill., Aug. 5.—C. W. Marks, a dentist of Chicago, was married Aug. 20.—A. S. Moore, a dentist of Schenectady, N. Y., married Miss Jeanette E. Maxson, of Lakewood, N. Y., Sept. 2.—E. T. Margarity, a dentist of Melvin, Ill., married Miss Leatha Dixon, of Melvin, Aug. 7.—A. E. Powers, a dentist at Birmingham, Ala., married Miss Dorna Miller, of Birmingham, July 23.—H. A. Smith, a dentist of Cadiz, O., married Miss Ada Schumacher, of St. Clairsville, O., July 22.—J. J. Schwartz, a dentist of Cincinnati, married Miss Beatrice Smith, of Cincinnati, Aug. 1.—E. E. Wottring, a dentist at Columbus, O., married Miss Irma V. Masters, of Prospect, O., Aug. 2.—A. Q. Warren, a dentist of Lowell, Mass., married Miss Harriet S. Doyle, of Nashua, N. H., Aug. 5.

ELECTRICITY AND BACTERIA.—Mr. A. G. Foulerton and D. A. M. Kellas have for some time past been investigating the effects of electrical discharges of high potential and rapid frequency on bacteria. The current discharge is

made close to the surface of the liquid containing the bacteria, and a platinum wire is let into the bottom of the test tube containing the liquid. Thus the charge may presumably be held to traverse the bacterial colonies. Very gratifying results were at first obtained. The bacillus of typhoid, the bacillus coli communis, the bacillus of dysentery, of anthrax, and several other characteristic bacteria of disease were swept away as by a plague. That was the result of the first experiments, made with the electric discharges taking place in air. Then it was suggested that the discharges should be made to take place with the whole experiment submerged in an atmosphere of hydrogen. A striking difference was obtained. The bacteria survived the exposure to electrical discharges for two hours! And the conclusion now come to by the investigators is that the bacteria are not killed by electricity, but by the acidity in the water due to nitrous and nitric acid which is produced by the electric discharges in the air. The germicidal acid is probably carried down into the fluid by the electrical discharges. The discharges of such currents over the skin may lead to a somewhat similar penetration of the tissues by chemical products, and the cures in cases of ulceration may be due to the germicidal action of chemical decomposition products formed in the air.

ROBBERIES.—Aug. 2, sneak thieves robbed S. A. Garth, Colorado Springs, of about $50 worth of gold.—J. D. Robertson, at East St. Louis, Ill., was robbed of $18 worth of material July 25.—G. H. Henderson and E. A. Kartack of Springfield, Ill., were robbed July 19 of about $75 worth of gold and materials.—July 29, two dentists at Olney, Ill., were robbed of about $25 worth of gold.—Aug. 2, P. J. Collins of Marshalltown, Ia., was robbed of $30 worth of gold.—Aug. 25, thieves at Brocton, Mass., robbed F. S. Faxon of $30 worth of gold and H. A. Bartlett of $25 worth.—Aug. 23, S. H. Chase of Haverhill, Mass., lost $200 through thieves; J. H. King lost $100, and G. E. Mitchell lost $50.—Aug. 18, A. Wilson of Ann Arbor, Mich., was robbed of $25 worth of material.—F. R. Nice of Lansing, Mich., was robbed Aug. 12 of $130 worth of gold and material.—C. Rausenberger of Germantown, Pa., was robbed July 23 of $100 worth of material.—Aug. 12, thieves at York, Pa., robbed H. E. Basehore, W. W. Bolton, E. L. Lewis, J. W. McKinnon, C. P. Rice, and Q. L. Ruth of gold and material aggregating about $500.—Aug. 9, thieves at Farmount, W. Va., made the following haul in gold and material: J. T. Hill, $125; H. C. McKay, $25; A. R. Badgeley, $90; J. O. McNeely, $50; N. L. Yost, $200.—Aug. 10, E. L. Smith, at Martinsburg, W. Va., was robbed of $200 worth of material.—Aug. 10, burglars at Clarksburg, W. Va., held up A. B. Hall for $25 in material, W. H. Hill for $100 and J. S. Stone for $40.—Aug. 12, A. Leeds, at Grafton, W. Va., was robbed of $40 worth of gold.—Aug. 9, Wm. Schlaeger of Milwaukee was robbed of $150 worth of gold and material.—Aug. 2, the office of H. M. Jackson at Milwaukee was robbed of $20 worth of gold.—This sort of thing seems to be getting worse instead of better. Usually nothing is taken but gold foil, scrap, etc. The scrap should not be allowed to accumulate, and the new gold should be hidden or carried home at night.

AD INFINITUM.

They've found the bug
That eats the bug
That fights the bug
  That bites us;
They've traced the germ
That kills the germ
That chews the germ
  That smites us.

They know the bug
That knifes the bug
That stabs the bug
  That jabs us;
They've seen the germ
That hates the germ
That biffs the germ
  That nabs us.

They've chained the bug
That bolts the bug
That jolts the bug
  That bings us;
They've got the germ
That gulps the germ
That nips the germ
  That stings us.

They hold the bug
That scolds the bug
That told the bug
  To pinch us;
They chase the germ
That helps the germ
That cheers the germ
  To clinch us.

They've struck the bug
That slays the bug
That flays the bug
  That sticks us;
They've jailed the germ
That guides the germ
That taught the germ
  To fix us.

But still these bugs—
Microbic thugs—

In spite of drugs
Combat us;
And still these germs—
Described in terms
Inspiring squirms—
Get at us.—*Life.*

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